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Being able to communicate one's wants and needs is an essential step in typical language development. However, children with diagnosed language delays, which constitute approximately 5–10% of children under three years, may reach this step later than typically developing children. According to Rossetti (2001), communication skills are the most highly correlated to future school performance than any other. The use of infant signing, a form of intentional symbolic gesturing, has been shown to support children's development in multiple domains for both typically developing children and children with disabilities (e.g., DiCarlo, Stricklin, Banajee, & Reid, 2001; Goodwyn, Acredolo, & Brown, 2000; Thompson, Cotnoir-Bichelman, McKerchar, Tate, & Dancho, 2007). However, there is limited research showing the effects of infant signs on young hearing children's communication skills (Vallotton, 2011c; Wijkamp, Gerritsen, Bonder, Haisma, & van der Schans, 2010).

The current study examined the potential effects of an infant signing intervention program on children's communication skills, both verbal and sign usage. The researcher conducted a single subject, multiple probe research design across three children (ages 12 to 36 months) with diagnosed language delays to study their communication skills before and after the signing intervention. A pre- and post-study child language inventory supported with qualitative data collection methods was used as well. Results suggest an increase in communication attempts via both spoken and manually signed words after a

primary caregiver-implemented infant signing intervention. Implications of these results are also discussed.

THE EFFECTS OF A PARENT IMPLEMENTED INFANT SIGNING INTERVENTION ON COMMUNICATION SKILLS FOR YOUNG HEARING CHILDREN WITH DIAGNOSED LANGUAGE DELAYS

by

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This work is dedicated to my father, James Eddie Blackburn, who has always pushed me to be my very best. Thank you Daddy for always believing in me and helping me see the bigger picture. Until I see you again, I love you.

APPROVAL PAGE

This dissertation, written by Ayrora Fain Barker, has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

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"'For I know the plans I have for you,' declares the Lord, 'plans to prosper you and not to harm you, plans to give you hope and a future.'" (Jer. 29:11, NIV, Bible)

"Yet those who wait on the LORD shall renew *their* strength; They shall mount up with wings like eagles, They shall run and not be weary, They shall walk and not faint."

(Isaiah 40:31, NKJV, Bible)

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CHAPTER I

INTRODUCTION

Rationale for the Study

As part of typical development, young children may encounter difficulties expressing their wants and needs with caregivers. Though this is an expected part of typical child development, it often creates frustration and stress among children and their caregivers (Brereton, 2008; Fusaro & Vallotton, 2011; Gongora & Farkas, 2009; Goodwyn, Acredolo, & Brown, 2000). This frustration may be amplified when young hearing children have developmental delays and/or disabilities (DiCarlo, Stricklin, Banajee, & Reid, 2001; Fidler, Philofsky, Hepburn, & Rogers, 2005; Thompson, Cotnoir-Bichelman, McKerchar, Tate, & Dancho, 2007; Toth, 2009). These children may develop their expressive language skills later than typically developing children, causing difficulties in communicating their wants and needs with their caregivers (Frank Porter Graham Child Development Institute, 2010).

According to recent literature, the use of infant signs can be very effective in multiple domains of development, including verbal language skills (Goodwyn et al., 2000; Toth, 2009), cognitive skills (Goodwyn et al., 2000), social skills (Toth, 2009), decreased frustration levels (Goodwyn et al., 2000), and self-regulation skills (Vallotton, 2008b) for children who have language delays but are otherwise considered to be typically developing. Infant signing involves the "use of gestures as symbolic

representations [in order to] mak[e] infants' communicative cues visible to both scientists and caregivers" (Vallotton, 2009, p. 353).

Infant signs can be distinguished from natural gestures, such as shaking or nodding the head, waving a hand, and pointing (McCauley & Fey, 2006), because infant signing involves an adult intentionally modeling signs to a child (Vallotton, 2009, 2010, 2011a, 2011b). As described by Vallotton (2012), infant signing is a term researchers use to describe symbolic gesturing by infants and toddlers. Therefore, it may be helpful to think of symbolic gestures as the broader term representing both natural gestures and infant signing.

Learning infant signs is different than learning sign language, such as American Sign Language (ASL), French Sign Language (FSL), Dutch Sign Language (DSL), and other formal systems of manual languages. According to the World Federation of the Deaf (2015),

> a sign language is a visual language that uses a system of manual, facial and body movements as the means of communication. Sign language is not a universal language, and different sign languages are used in different countries, like the many spoken languages all over the world. (para. 1)

More specifically, American Sign Language (ASL), the primary language for North Americans who are deaf or hard-of-hearing, "is a complete, complex language that employs signs made by moving the hands combined with facial expressions and postures of the body" (The National Institute on Deafness and Other Communication Disorders, 2015, "What is American Sign Language," para. 1). The current study examined the use

of infant signs as a means to enhance communication for young children with language delays, rather than examining sign language as a whole.

Figure 1 illustrates how terms such as symbolic gestures, infant signs, naturally occurring gestures, and sign language are related in order to better understand the connections between them. The term symbolic gestures, which represent their referents in their absence, carry their meanings in the manual form and may even resemble reference concepts (e.g., throwing or rolling a ball as a symbolic gesture for "ball"; Goodwyn et al., 2000; Werner & Kaplan, 1963).

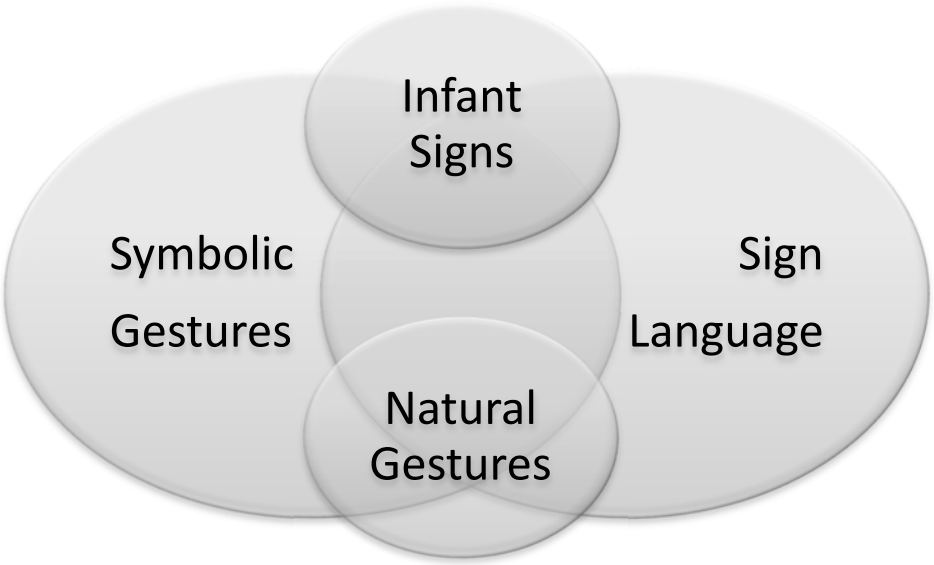

Figure 1. Sign and Gesture Distinctions.

These symbolic gestures represent a broader term, which may include some of the naturally occurring gestures as well as some infant signs, as modeled by an adult, hence the overlap in Figure 1. Symbolic gestures also make up part of the manual language used in official sign languages such as American Sign Language (ASL), which is also

represented by the overlap in Figure 1. For example, the ASL sign for "write" consists of making a writing motion with one hand while the other hand acts as the paper, hence becoming the referent as seen in symbolic gestures. The same is seen for the ASL sign "house."

The term sign language may also include some of the naturally occurring gestures (e.g., waving hand for hello or goodbye) as well as some infant signs (e.g., those borrowed from sign language such as "eat" or "drink"). Infant signs do not include any naturally occurring gestures, however, since infant signs are taught or modeled by an adult for use by preverbal children (Goodwyn & Acredolo, 1993). Rather, infant signing is a popular term researchers use to describe symbolic gesturing by infants and toddlers (Vallotton, 2012). Infant signing is the "use of gestures as symbolic representations—makes infants' communicative cues visible to both scientists and caregivers" (Vallotton, 2009, p. 353).

Figure 1 also indicates the overlap in the terms sign language and infant signs as well as sign language and natural gestures. Because infant signing began by originally borrowing well known signs from the deaf culture (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979), which uses sign languages as the primary mode of communication, the similarities between these two terms can be easily distinguished. For example, the infant sign for "ball" is the same as in American Sign Language. Similarly, the overlap in Figure 1 between sign language and natural gestures can be best understood when looking at the sign for "you" or "me." These signs are the same as the natural gestures

created when a child naturally refers to himself or another person by simply pointing in the correct direction.

Finally, as seen in Figure 1, the only two terms that do not overlap are infant signs and natural gestures. The reason for this lies in the definition for infant signs. Even though Vallotton (2009) refers to infant signing as the "use of gestures as symbolic representations" (p. 353) for communication purposes, she further describes infant signing as involving an adult intentionally modeling signs to a child (Vallotton, 2009, 2010, 2011a, 2011b). Therefore, the two terms do not overlap.

As further discussed in the literature review chapter, research conducted on groups of hearing children with disabilities indicates developmental growth, including those with Autism Spectrum Disorder (Barrera, Lobato-Barrera, & Sulzer-Azroff, 1980; Nunes, 2008; Tincani, 2004; Yoder & Layton, 1988), Down syndrome (DiCarlo et al., 2001; Iacono & Duncum, 1995; Powell & Clibbens, 1994; Romski & Ruder, 1984; Thompson et al., 2007), intellectual disabilities (Kouri, 1988; Tincani, 2004), Pervasive Developmental Disorder (Tincani, 2004), Cerebral Palsy (DiCarlo et al., 2001; Tait, Sigafoos, Woodyatts, O'Reilly, & Lancioni, 2004), and speech and language disabilities (Wijkamp, Gerritsen, Bonder, Haisma, & van der Schans, 2010). Although this research suggests that introducing infant signing is helpful to prelinguistic hearing children, who are both typical in their development and those with disabilities and/or developmental delays, there is little documented research on whether hearing children with language delays may benefit from the use of signing.

Research Problem

Language development for typically developing children has long been studied (Rosetti, 2001). In addition, research has focused on sign language as a language for children and adults who are deaf or who have hearing impairments (Bailes, 2001; Barnes, 2010; Briggle, 2005; Campbell, MacSweeney, & Waters, 2007; Daniels, 2001; Falkman & Hjelmquist, 2006; Morgenstern, Caët, Collombel-Leroy, Limousin, & BI'londel, 2010; Poveda, Pulido, Morgade, Messina, & Hedlova, 2008; Takei, 2001) as well as on signing as a means of communication for children without hearing impairments (Barrera et al., 1980; DiCarlo et al., 2001; Goodwyn et al., 2000; Iacono & Duncum, 1995; Kouri, 1988; Nunes, 2008; Powell & Clibbens, 1994; Romski & Ruder, 1984; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2008a, 2008b; Wijkamp et al., 2010; Yoder & Layton, 1988). However, little research has been conducted on the use of signing with hearing children who also have diagnosed language delays (Vallotton, 2011c). This study adds to the research field by demonstrating the use of infant signs with a group of young hearing children with diagnosed language delays and how signing in a natural environment may enhance their intentional communication skills with their primary caregiver.

Purpose of the Study

This study investigated the potential benefits of using infant signs on the expressive language skills of young children with language delays. The following research question guided this study:

What is the effect of a primary caregiver-implemented infant signing intervention on the frequency of spontaneous and prompted communication attempts, as measured by spoken, signed, or both modalities, for young hearing children with diagnosed language delays when implemented within the child's natural environments and during natural scenarios?

The independent variable for this study was the infant signing intervention. Primary caregivers were trained to use infant signs with their children who had diagnosed language delays in order to communicate their needs and wants. Families were recruited from North Carolina Early Intervention services, local childcare centers, and through personal communication with either the principal investigator or families who had already been recruited. Recruited families were asked to fill out a brief demographics survey as well as to participate in a brief primary caregiver interview before the intervention began. These measures provided information regarding family descriptives.

The two dependent variables included the number of spontaneous independent and prompted intentional communication attempts (spoken and/or sign) made by the child to communicate the child's needs and wants after the signing intervention began. To answer the research question, a multiple probe single-subject study was implemented and an adapted short form of the *MacArthur Communicative Developmental Inventory (CDI)* to include the "*Gestures*" section from the long form of the same instrument were also administered via primary caregiver report before and after the signing intervention to determine the child's receptive and expressive language skills (C. Vallotton, personal communication, February 19, 2015; Fenson et al., 2007). Collecting this language data

prior to beginning the infant signing intervention assisted the researcher and primary caregiver decide which signs/words were the most motivating for the child.

In the following chapter, Chapter II: Literature Review, the theoretical framework and perspectives guiding this research are discussed first, followed by the historical use of signing with the hearing population and what previous infant signing research has suggested.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Many factors contribute to the language development of children with typical hearing capabilities, specifically those under three years of age, including the home environment (Rogoff, 2014), and other external factors. One such external factor for children with diagnosed language delays includes interactions with professionals, such as Early Interventionists. These professionals usually interact with the families and children with special needs on a regular basis and typically earlier than with children who are typically developing. Young children with developmental delays and their families often need language interventions that assist families and professionals better understand one another. One such intervention is that of infant signing. According to Vallotton (2012), "infant signing," otherwise known as a form of symbolic gesturing, may promote bidirectional communication and encourage more positive interactions between prelinguistic children and their primary caregivers. Research has shown positive developmental effects in the areas of social-emotional and language skills, for using infant signing with typically developing children (Brereton, 2008; DiCarlo et al., 2001; Goodwyn et al., 2000; Perez et al., 2001; Tait et al., 2004; Tincani, 2004; Thompson et al., 2007; Toth, 2009; Wijkamp et al., 2010; Vallotton, 2008a, 2008b, 2010, 2011b, 2012). Research has also shown positive developmental effects for a few specific groups

of children with disabilities such as Cerebral Palsy, Autism, Down syndrome, fetal alcohol syndrome, learning disabilities, and children at risk for developmental delays (DiCarlo et al., 2001; Wijkamp et al., 2010; Perez et al., 2001; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2012). However, little research has shown how infant signing may assist young children with typical hearing when they have been diagnosed with language delays (Vallotton, 2011c; Wijkamp et al., 2010).

As indicated by the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004 (20 U.S.C. § 1432(4)(G)), young children learn best in their most natural environments, which often includes the homes in which they live. As seen in Figure 2, a child's natural environment has the potential to make a great impact on both the child's current level of language and the potential level of language they may reach in the future with assistance, or scaffolding, from an adult (e.g., primary caregiver during the current infant signing intervention; Wood, Bruner, & Ross, 1976). In this chapter, the theoretical framework and perspectives guiding this research are discussed first followed by the historical use of signing with the hearing population and what previous infant signing research has suggested.

Theoretical Framework

Children learn how to communicate with their caregivers in their home environments naturally, through a process known as language development (Rogoff, 2003). According to Maljaars, Noens, Scholte, and van Berckelaer-Onnes (2012), language development consists of both receptive language (understanding language) and

expressive language (producing language). Receptive language typically develops at a much earlier age than expressive language for most children, however the expressive stage may be further delayed for children with diagnosed language delays (Owens, 1996; Rosetti, 2001). Although much research has been conducted in the general area of language development as a whole, there is much to learn and many questions still unanswered. In the current study, communication is viewed through the lens of Vygotsky's sociocultural theory (1978) and the most basic tenet of his theory, the "zone of proximal development," as well as Wood et al.'s (1976) term "scaffolding." In the following theoretical framework, the importance of the family within the natural home environment will be discussed in relation to Vygotsky's theory. Next, Vygotsky's zone of proximal development will be explained, which will serve as a foundation for the remainder of the section. A discussion of ontogenesis and how children decontextualize learned information will then be presented while simultaneously relating scaffolding and internalization to the current study. Finally, more recent research is discussed in relation to the previous framework, as well as the knowledge that research has made to the field.

Vygotsky's sociocultural theory (1978) is most relevant to this research because of the focus on the family and the important role the primary caregivers have when interacting with their children. Other researchers have reiterated the importance sociocultural theory places on the social aspect of children's home environments (Fabes & Martin, 2003). This includes the experiences children have while in these environments including daily activities, language, and play (Vygotsky 1966, 2004) with the family members living in that immediate space. Furthermore, Bradley (1993)

suggests that the most influential factor in a child's language development is their most proximal environment, most likely the environment in which they live. Finally, previous research by Wulbert, Inglis, Kriegsmann, and Mills (1975) found that the majority of language-delayed children in their study were from homes that had significantly poorer quality home environments than children with typical language development. These results further support the important role the home environment plays regarding support for children's' language development. Therefore, Vygotsky's sociocultural theory provides an ideal theoretical background for understanding the progression of young children's language skills as well as the adult's role in teaching young children.

Within the context of his sociocultural theory, Vygotsky (1978) explains his term "zone of proximal development" as "the distance between [a child's] actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (pp. 86). Furthermore, the term "scaffolding" (Wood et al., 1976) is used to describe Vygotsky's idea of this adult guidance that is provided. With an adult's help, or the help of different developmental services such as a signing intervention, children with language delays may reach their higher potential, thus reaching the higher end of their current zone of proximal development. Scaffolding can be thought of as the means by which the child's current skills can be further developed so that they can reach their high potentials within the zone of proximal development.

Accordingly, primary caregivers and teachers can be seen as language facilitators for children by means of scaffolding language (Berk & Winsler, 1995). For example,

when children are first learning a new word, the word is initially unknown; hence the child is at the bottom of his zone of proximal development. When an adult speaks this new word in proximity of the child, the adult is then introducing the word into the child's future vocabulary, hence scaffolding new information for the child. Now the child has the potential to learn the new word, with repeated use by the adult, and further scaffolding, which may result in the child reaching the top of his zone of proximal development for that particular skill.

During these natural learning experiences, when introducing a new cultural or psychological tool, such as infant signing, into the environment, the activity is then transformed into one in which the child may be able to understand and participate (Wertsch, 1985). According to Vygotsky (1978), the psychological tool alters the way one thinks, by adapting the thought process of the original activity. This is similar to the way a technical tool (e.g., hammer) alters the process of physical labor, by changing the way we approach the physical labor. The process where the adult assists the child in gaining these new skills is referred to as scaffolding (Wood et al., 1976), as discussed previously. According to Wood et al. (1976), when adults scaffold information to a child, they are potentially decreasing the distance between what a child can do alone and what he/she can do with help. The distance that the scaffolding assists the child in achieving is what Vygotsky refers to as the zone of proximal development (1978; Wang & Brown, 2009). For example, any child attempting a new skill shows only his/her current level. However, with scaffolding by another, more skilled adult or peer, a child may reach a new skill level, one that is slightly above where he/she was previously. However, the

child may not yet reach his or her full future skill level. Children with any type of disability or delay, language for instance, may need even more scaffolding, meaning the adults in the child's environment (i.e., home) should be "providing assistance to children that is responsive to their current level of progress and . . . spur[ring] their development by capitalizing on momentary instructional opportunities" (Berk & Winsler, 1995, p. 115).

Vygotsky describes the term "ontogenesis" of development as the simultaneous occurrence of children's' social interactions and genetic makeup while promoting development and growth (Wertsch, 1985). According to Vygotsky (1978), every function in the child's development occurs on two levels. First, it occurs on the social level, where the child is seen imitating actions or sounds made by others for the sake of imitation or attention. Then the function occurs on the individual level, where the child is able to internalize what he/she has just learned and reproduce this action at a later point. During social interactions, once the adult begins the scaffolding process of teaching the child a new skill, the child begins to internalize this new information cognitively (Wertsch, 1985). Relationships with others serve to help the child develop his/her skills as an individual (Wertsch, 1985, p. 179). One such relationship occurs during the child's "apprenticeship" with an adult (Wertsch, 1985), which is described as when the child learns new skills and begins practicing for himself or herself how adults speak as well as how to use cultural tools and objects (Vygotsky, 1978). For example, according to Vygotsky (1978), when a primary caregiver teaches a child a new word or infant sign for an object, the child begins practicing the word or infant sign for social reasons alone at

first, but then internalizes the meaning of this new tool, and finally becomes an independent user of this information by externalizing it physically through speaking or signing.

The process of how children internalize what is taught to them and then externalize it back physically demonstrates that they have grasped the new skill (Vygotsky, 1986). This process is called "internalization" and is described by Vygotsky as "the process of transformation of external actions into internal psychological functions" (pp. xxvi). For example, a child that is taught a word by his primary caregiver must first understand this word internally before he can produce the word himself in the appropriate context. The process used by the child to take what was a meaningless word and turn it into a communication tool by understanding how to use it shows the child has internalized the new word taught by his primary caregiver.

Vygotsky's "principle of decontextualization of mediational means" (Wertsch, 1985, p. 33) also helps us better understand how children learn language. According to this principle, children learn to think in more abstract ways related to words they are learning, therefore decontextualizing them (Wertsch & Tulviste, 1992). For example, when a child learns a new word, he may need the original context in which that word was learned in order to make sense of the new word until he understands them in different contexts. This term is explained by Wertsch (1985) as "the process whereby the meaning of [words] become less and less dependent on the unique spatiotemporal context in which they are used" (p. 33). Language delays may be the result of a child not having such skills.

According to Moyle, Stokes, and Klee (2011), between 10 and 20 percent of children under three years of age are identified as late talkers, which may be an early sign of future language impairments. Although these children may be able to internalize and understand receptively what others in their environment are saying to and around them, if these young children have expressive language delays, they may not have the verbal capabilities to express their own needs and wants to their caregivers. Therefore, although these children may be able to internalize these skills, they may not yet be able to externalize them by verbally responding to their environments appropriately. Therefore, in order to promote a child's optimal language development, early stimulation in the home environment is essential (Bradley, 1993; Bradley & Caldwell, 1976; Bradley & Caldwell, 1984; Bronfenbrenner, 1986; Brooks-Gunn, Klebanov, & Duncan, 1996; Brooks-Gunn, Klebanov, & Liaw, 1995; Cleveland, Jacobson, Lipinski, & Rowe, 2000; Elardo, Bradley, & Caldwell, 1975; Gottfried, Fleming, & Gottfried, 1998). The goal of the current study was to identify these late talking children and provide a language intervention for them, which would also serve as a stimulating experience within their natural environments.

Vygotsky has also been referred to as the "father of defectology" (Wang, 2009, p. 103) for his great contributions to the field of special education. According to Wang (2009), the zone of proximal development for children with special needs should allow gradual assistance and guidance which then prompts his cognitive and therefore other areas of development. Additionally, Wang (2009) states that "according to Lev

Vygotsky's [idea] of Zone of Proximal Development, what's important to disabled children is 'what they can do', not 'what they are supposed to do'" (p. 103).

When attempting to understand Vygotsky's sociocultural theory (1978), it may be helpful to view the topic of language development through the lens of similar research. Rogoff (2014) describes what the sociocultural theory describes as ontogenesis by means of progression through the zone of proximal development as "learn[ing] through observing and beginning to participate" (p. 133). Rogoff goes on to describe the process where children learn from more "informal" schooling. For example, when learning to communicate with others, Rogoff views the "learning by observing and pitching in" process as a natural, informal process by which the child and his/her environment interact and learn communication attempts from one another; therefore, promoting the child's communication and language skills within that environment. According to Rogoff, this more natural approach of "learning by observing and pitching in" allows the learner (e.g., the child) a more naturally integrated participation in his/her environment and those around him and it makes the child more "eager to contribute and belong," as well as encouraging a "wide, keen attention" by the child during the learning experiences (p. 73).

Similarly, other researchers also echo the importance of the natural environment as well, especially for infants and toddlers with disabilities or developmental delays. McWilliam (2011) states that while providing services in the home is important, what may be of more importance is the provision of services to the child while simultaneously teaching the primary caregivers. For example, McWilliam's research suggests that modeling an approach to a family is most beneficial for both the child and primary

caregivers because the modeling process directly involves the primary caregivers' participation. This way, the intervention can carry on when the practitioner is no longer at the child's home, as provided by the primary caregiver.

The major tenets of Vygotsky's sociocultural theory (1978), when supported by other researchers' views on the importance of a child's natural environment (McWilliam, 2011; Rogoff, 2014) provides a framework in which to view language development in early childhood. Hearing children with language delays are also better understood when using the same framework, because of the focus on the comfort of the environment and those they are most in contact with. In order to better meet the needs of young children with language delays, the current study examined the impact the intervention has on the children within their most natural home environments (IDEA, 2004 (§303.26); Rogoff, 2014) when learning infant signs from their primary caregivers in hopes to stimulate and enhance their current levels of language development.

Language Development: Previous Research, History, Interventions, and Future Directions

According to the Individuals with Disabilities Education Act of 2004 (IDEA), an "infant or toddler with a disability" is defined as a child under three years of age and is "experiencing developmental delays" in at least one of the following areas: cognitive development, physical development, communication development, social or emotional development, or adaptive development (IDEA, 2004 §303.21 (a)(1)(i-v)). The definition also includes children with a "diagnosed physical or mental condition" causing a "high probability of developmental delay" including "conditions such as chromosomal abnormalities; genetic or congenital disorders; sensory impairments; inborn errors of

metabolism; disorders reflecting disturbance of the development of the nervous system; congenital infections; severe attachment disorders; and disorders secondary to exposure to toxic substances, including fetal alcohol syndrome," as well as children considered "at-risk" for developing developmental delays, "at a State's discretion" (IDEA, 2004 §303.21 (a-c)).

Many factors affect the way a child develops as well as the way that child may meet the challenges of the disability. These include the primary caregivers' and their child's individual characteristics, as well as the way professionals interact and support families of children with delays. When working with children who have been diagnosed with language disabilities, specifically those who have difficulty producing or comprehending language as compared to other children their age, many interventions have been attempted throughout the years. One such intervention is infant signing, which was adopted from the Deaf community into the hearing community (Garcia, 2003) and has shown social-emotional and language benefits with typically developing children (Brereton, 2008; Daniels, 2004; DiCarlo et al., 2001; Gongora & Farkas, 2009; Goodwyn et al., 2000; Howlett, Kirk, & Pine, 2011; Kirk, Howlett, Pine, & Fletcher, 2013; Thompson et al., 2007; Vallotton, 2008a, 2008b, 2009, 2010; 2011b). These practices have also benefitted children with disabilities such as Cerebral Palsy, Autism, Down syndrome, fetal alcohol syndrome, learning disabilities, and children at risk for developmental delays (Brereton, 2008; DiCarlo et al., 2001; Goodwyn et al., 2000; Perez et al., 2001; Tait et al., 2004; Tincani, 2004; Thompson et al., 2007; Toth, 2009;

Vallotton, 2012; Wijkamp et al., 2010). However, young children with language delays have not been studied as commonly as other groups.

The current literature review is a current and comprehensive review of the topic of infant signing with young hearing children with and without diagnosed disabilities (Denney & Tewksbury, 2013; Galvan, 2009). This process first began with selecting the topic of language development, which was of interest to the researcher. The next step included researching scholarly journal articles and reading literature on the topic in order to find the gaps in previous research (Webster & Watson, 2002). This review began with searching multiple online databases including ERIC, Wilson Web, EBSCO, Google scholar, PsychInfo, and Academic Search Premier. During the search process the following descriptors were used to identify studies relevant to the parameters: infant, toddler, child*, infant sign*, sign language, and excluded descriptors such as deaf, hard of hearing, and hearing impair*. From the initial search results, empirical, peer-reviewed studies were selected that focused on children receiving infant signing or sign language intervention, and can be seen in Table 1. A few studies report findings on children already signing, therefore not receiving a signing intervention for the purposes of the study. These studies were denoted within the table with an asterisk (DiCarlo et al., 2001; Howlett et al., 2011; Vallotton, 2009, 2010, 2011b; Wijkamp et al., 2010). An expert within the field of infant signing with young children, Dr. Claire Vallotton, was contacted to ensure all studies discussing this topic were included. In an effort to ensure that the collection of accepted studies included all relevant studies on this topic, the reference lists of each study that fell within the search parameters were also reviewed. The remaining

18 studies included in this review are believed to be the only studies that satisfy the requirements of the current literature search. These studies can be seen in Table 1.

After identifying the 18 studies, an outline was created, which was edited and revised many times before and during the writing process (Denny & Tewksbury, 2013). The resulting literature review of these 18 studies is organized into three primary sections:

1. a description of typical language development and communication
2. an introduction to infant signing, the historical context, different approaches to teaching infant signs and a review of the potential benefits for children with and without disabilities; and
3. the importance of the family-child interaction related to young hearing children with language delays.

The articles specifically reviewed on infant signing appear in section two. All topics are discussed in further detail in the following sections.

Language Development and Communication

For the purposes of this study, language, as defined by Owens (1996), is a social tool consisting of a complex set of rules for using symbols such as letters and words. According to Merriam-Webster dictionary (2013), language is defined as "the system of words or signs that people use to express thoughts and feelings to each other" and communication is defined as "the act or process of using words, sounds, signs, or behaviors to express or exchange information or to express your ideas, thoughts, feelings, etc., to someone else." Thus, language can be thought of as the system being used in

Table 1

Overview of Studies

Articles	Ages of Child(ren)	Disabilities	Setting	Country	Results of Signing
Brereton (2008)	Preschool (*n*=34)	◦ Typically developing	Classroom with teacher	USA	◦ Increased students' appreciation for diversity
Daniels (2004)	Kindergarten (*n*=41)	◦ Typically developing	Classroom with teacher	USA	◦ Increased receptive language skills ◦ No significant expressive language
*DiCarlo et al. (2001)	15–36 months (*n*=23)	◦ Autism ◦ Cerebral Palsy ◦ Down syndrome ◦ Typically developing	Classroom with teacher	USA	◦ Increased expressive and receptive language skills ◦ Increased social behaviors
Goodwyn et al. (2000)	11–36 months (*n*=103)	◦ Typically developing	Home with primary caregiver	USA	◦ Decreased primary caregiver frustration
Gongora and Farkas (2009)	5–9 months (*n*=14)	◦ Typically developing	Home with primary caregiver	Chile	◦ Increased visual and tactile interaction between mother and child

Table 1

(Cont.)

Articles	Ages of Child(ren)	Disabilities	Setting	Country	Results of Signing
Harding, Lindsay, O'Brien, Dipper, and Wright (2011)	6 years (*n*=2)	◦ Profound and Multiple Learning Disabilities	Classroom with teacher	USA	◦ Increased expressive and receptive language skills ◦ Increased social behaviors
*Howlett et al. (2011)	3–36 months (*n*=178)	◦ Typically developing	Primary caregiver Signing Classes	England	◦ No relationship between infant signing and primary caregiver stress
Kirk et al. (2013)	8–20 months (*n*=40)	◦ Typically developing	Primary caregiver Signing Classes	Britain	◦ No language differences ◦ Increased maternal responsiveness to infants' nonverbal cues ◦ Increased maternal encouragement and independence
Tait et al. (2004)	16–47 months (*n*=6)	◦ Cerebral Palsy	Home with primary caregiver	Australia	◦ Increased expressive and receptive language skills ◦ Increased social behaviors ◦ Increased social behaviors

Table 1

(Cont.)

Articles	Ages of Child(ren)	Disabilities	Setting	Country	Results of Signing
Thompson et al. (2007)	6–10 months (*n*=4)	‣ Down Syndrome ‣ Typically developing	Classroom with primary caregiver	USA	‣ Decreased crying & whining ‣ Increased signing
Tincani (2004)	5–6 years (*n*=2)	‣ Autism/ Intellectual Disability ‣ Pervasive Developmental Disorder- Not Otherwise Specified	Classroom with teacher	USA	Mixed Results: ‣ Child 1- Moderate motor imitation skills, imitating 43% of 76% response attempts ‣ Child 2- Weak motor imitation skills, imitating 20% of 78% response attempts
Toth (2009)	0–6 years (*n*=38)	‣ Autism ‣ Down syndrome ‣ Fetal Alcohol Syndrome Disability	Home and school	Canada	‣ Increased attention to other's language attempts ‣ Increased communication via signing
Vallotton (2008a)	5–22 months (*n*=22)	‣ Typically developing	Classroom with teacher	USA	‣ 91% of children used signs modeled by an adult ‣ 50% of children used signs to express emotions/feelings

Table 1

(Cont.)

Articles	Ages of Child(ren)	Disabilities	Setting	Country	Results of Signing
*Vallotton (2009)	4–19 months (*n*=10)	◦ Typically developing	Classroom with teacher	USA	◦ Frequency of gestures and signing positively correlate with caregiver responsiveness ◦ Signing elicits most responsiveness
*Vallotton (2010)	4–19 months (*n*=10)	◦ Typically developing	Classroom with teacher	USA	◦ Early pointing behaviors predicted earlier symbolic gesturing ◦ Symbolic gesturing did not decrease pointing behaviors
*Vallotton (2011b)	4–20 months (*n*=10)	◦ Typically developing	Classroom with teacher	USA	◦ Gesture sentences were produced
Vallotton (2012)	10–36 months (*n*=29)	◦ At-risk for developmental delays	Home with primary caregiver	USA	◦ Increased signing ◦ Mothers' were more attuned to changes in children's affect and more responsive to children's distress cues. ◦ Mothers viewed their children more positively

Table 1

(Cont.)

Articles	Ages of Child(ren)	Disabilities	Setting	Country	Results of Signing
*Wijkamp et al. (2010)	32–55 months (*n*=8)	‣ Severe language disabilities	Classroom with teacher	Netherlands	‣ Less use of signs than early gestures ‣ No decrease in verbalizations

*non-intervention studies

order to communicate with others. For the purposes of this study, the Merriam-Webster definitions of these terms are be used.

Communication within the environment impacts the child beginning in utero (Fabes & Martin, 2003). Within the mother's womb, the unborn child begins to hear his mother's language. After birth, the hearing newborn begins to show innate preferences toward his mother's voice (Fabes & Martin, 2003). This is the beginning of the communication stage in which the child is learning how to interact socially. As with all hearing children, language then develops into a means of communicating our wants and needs with those in our immediate environment. Unfortunately, this developmental trajectory may be slowed down for some children who are experiencing disabilities or delays

Most children with developmental and physical disabilities, like typically developing children, attain at least a prelinguistic level of communication without needing explicit instruction or interventions (Sigafoos, Butterfield, & Arthur-Kelly, 2006). These prelinguistic skills begin to appear in only nonverbal forms such as proto-imperatives (e.g., pointing at a nearby object in order to draw another's attention to the object) and proto-declaratives (e.g., requesting another person to carry out an action by pointing to an object the child wants at that time; McCauley & Fey, 2006; Rosetti, 2001). This prelinguistic communication period typically begins at birth and continues until the child is gradually able to communicate using words as the primary means of communication (Yoder, McCathren, Warren, & Watson, 2001), usually lasting until around nine to twelve months of age for most typically developing children (Center for

Disease Control and Prevention, 2009). However, for children with disabilities, this prelinguistic period may be extended.

During the prelinguistic stage, the child goes through pre-intentional communication followed by intentional communication (Yoder et al., 2001). During the pre-intentional stage, children's behaviors are presumed to have no intended outcome and are not directed toward anyone (Yoder et al., 2001). According to Vygotsky (1978), children during this time are using their communication solely for social purposes only, in order to get social responses such as smiles, which they later internalize for better understanding in order to communicate physical wants and needs such as toys or food. During this stage, Yoder and colleagues (2001) explain that children are not using coordinated eye gaze as they do later to have their needs met.

The next stage is referred to as intentional communication and includes behaviors such as coordinated eye gaze, vocalizations, and gestures to communicate with another person (Yoder et al., 2001). Yoder and colleagues (2001) define this stage as an "unconventional gesture or vocalization with coordinated attention to [an] adult and object or event" or a "conventional gesture or symbol with attention to adult" (p. 141). Unfortunately, many children with disabilities do not make this critical transition from pre-intentional to intentional communication, which causes an inhibited development of their symbolic communication skills (Yoder et al., 2001). The definition Yoder and colleagues give of intentional communication is used throughout the remainder of this review.

According to Cook, Tessier, Klein, and Armbnister (2000), adults also play an important role during the intentional communication stage, by responding to the child's communication attempts. Warren and Yoder (1998) suggest that adults have the responsibility of responding to the child's language attempts in two different ways: linguistically and non-linguistically. Adults can respond non-linguistically to a child's communication attempts by imitating the child's physical actions or responding non-verbally to them in other ways (e.g., handing the child an object when the child points toward it) (Warren & Yoder, 1998).

According to Brazelton's (1999) Touchpoints Model, natural milestones, or "touchpoints," occur during infancy and toddlerhood, such as learning to communicate one's wants and needs. Brazelton (1999) suggests that practitioners can help families feel more confident in their primary caregiver skills by viewing their young children's milestones more proactively, in order to have a jumpstart on the more difficult aspects of each milestone. For young children learning to communicate their wants and needs with their caregivers, this is especially important. During this time, although typical, primary caregivers and children alike can easily become frustrated, not knowing how to communicate with each other. This can be even more so for children who have language delays.

For children with language delays, the verbal aspect of language, otherwise known as expressive language (as opposed to gestures, eye contact, joint attention, and turn-taking behaviors, otherwise known as receptive language; Maljaars et al., 2012) may be delayed, causing these children to struggle with verbal communication.

Communication intervention, therefore, is a major priority for these children because they may lack the ability to produce speech and verbal language. According to Goldstein and Prelock (2009): "Language treatment has been shown to improve functional communication skills, thereby enhancing the quality of life, social, academic, and vocational opportunities of the child" (p. 1). Therefore, it is imperative for the child and family that the child with a language delay receives a language intervention geared toward the child's communication needs.

Infant Signing

Infant signing has been shown beneficial to many groups of children with and without disabilities (e.g., Brereton, 2008; DiCarlo et al., 2001; Goodwyn et al., 2000; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2010, 2011b, 2012; Wijkamp et al., 2010). An overview of the historical context of using infant signing with those in the hearing population is provided in this section as well as an introduction to the various approaches to teaching infant signing to children. Finally, a review of the benefits resulting from previous research on this topic is discussed. The current study consisted of an infant signing intervention with young hearing children who have been diagnosed with language delays and are receiving services from the North Carolina Early Intervention program in their home environments.

Historical Context of Infant Signing with the Hearing Population

The use of infant signing spawned both from the use of sign language in the Deaf community and the use of naturally occurring gestures. During the 1970s one researcher studied the role of natural gestures in prelinguistic children and found that between the

ages of 9–13 months, gestures marked an onset of intentional communication via requests, giving, showing, and pointing (Bates et al., 1979). These gestures were found by Bates et al. (1979) to be prior to the child's first spoken words.

Research conducted throughout the 1980s and 1990s furthered the previous research by showing that prelinguistic children were capable of communicating with others via gestures and/or signing (Acredolo & Goodwyn, 1985, 1988; Daniels, 1993, 1994a, 1994b, 1996a, 1996b, 1997; Goodwyn & Acredolo, 1993; Goodwyn et al., 2000; Namy, Acredolo, & Goodwyn, 2000; Vallotton, 2008a). For example, pioneers in this field completed the first large scale national study on gesturing in infancy (Goodwyn et al., 2000) and found that young children who experienced infant sign training versus those who did not showed more verbal language development, as suggested by language scores on the *MacArthur Communicative Developmental Inventory* (Fenson et al., 2007). Daniels's (1993, 1994a, 1994b, 1996a, 1996b, 1997) intervention studies also showed developmental improvements for hearing children experiencing signing. Daniels (1993) studied 14 hearing children of deaf primary caregivers and found that children who learned American Sign Language as preschoolers acquired a larger English vocabulary than is expected of typical children. Daniels's work has also shown that young children experiencing signing in their daily routines showed better vocabulary outcomes (1994a, 1996b) and that the number of years the teacher (or primary caregiver) has with using signs has no effect on the children's ability to grasp it or not (1997).

In the later 1990s and early 2000s, the new concept of "mirror neurons" became popular because of the research from Rizzolatti and Arbib (1998) and Rizzolatti and Craighero (2004). According to Rizzolatti and Craighero (2004), "mirror neurons":

> . . . represent the neural basis of a mechanism that creates a direct link between the sender of a message and its receiver. Thanks to this mechanism, actions done by other individuals become messages that are understood by an observer without any cognitive mediation. (p. 183)

Furthermore, Rizzolatti and Craighero (2004) also reference Vygotsky's work regarding object-directed actions. For example, Vygotsky (1934, as cited in Rizzolatti & Craighero, 2004, 1986) suggested that children begin pointing gestures in an original attempt to reach an object, which is then understood by others as wanting that object. This then becomes an understood action between both the child and adult. This is also what Vygotsky (1986) refers to as "internalization" (p. xxvi).

During the same time other researchers (Capirci, Iverson, Montanari, & Volterra, 2005) found that gestures are an integral part of learning speech. Specifically, Capirci and colleagues (2005) found that typically developing hearing children communicate using gesture in order to have their needs and wants met between the ages of 16 and 20 months. In the majority of infants studied, the use of gestures quickly shifted to more of a vocal modality in the typically developing, hearing children studied.

Obviously, the use of gesturing in the hearing community is not a new concept. Neither is the use of sign language within the Deaf community. However, using signs in the hearing community is fairly new. Joseph Garcia, a previous sign language interpreter, saw the need for Deaf primary caregivers and hearing children to better communicate

with each other (Garcia, 2003). After realizing this need, he developed the program known as "Sign with your Baby" as a means for these primary caregivers to communicate with their hearing infants. This is one of the most well-known introductions of signing for hearing children of deaf primary caregivers. Of course, the purpose of Garcia's program was to link the hearing and deaf together via signs, but this was then seen by researchers and practitioners as a way to better communicate, and possibly increase developmental skills of all hearing children (with or without deaf primary caregivers), as seen below.

There have also been multiple studies conducted with both hearing and non-hearing primary caregivers of young hearing children learning infant signs or gestures (Johnson, Durieux-Smith, & Bloom, 2005). Johnson et al. (2005) found that, out of the 17 studies they reviewed between 1980 and 2003, there was no clear support to the claim that signing advances a child's development. However, it is apparent through studying this review that the reasons behind this failure of support may be related to the many methodological weaknesses in the studies reviewed. Those weaknesses include: (a) no random control; (b) inadequate comparison groups; (c) small sample sizes; (d) poor follow-up; and (e) inadequate monitoring.

Other studies suggest signing/gesturing increases children's vocabulary capabilities. Vallotton (2008a, 2011a, 2011b) and Vallotton and Ayoub (2010) have studied the effects infant signing and gesturing has on a child's social-emotional skills as well as their self-regulation abilities. This is an important turn in the research on this

field because it shows that infant signing may have a positive effect on more than one developmental domain.

The potential for infant signing to show positive effects for more than language development in typically developing children shows a great possibility for future intervention effects on this topic with other groups of children as well as other areas of development. The current gap in research on using infant signs with young prelinguistic hearing children with language delays provides an opportunity for the current study to focus on this population.

Approaches to Signing

As with any implementation, there are many different approaches to signing. Infant signing first originated from the field of naturally occurring gestures, such as head nodding, reaching, and pointing (Acredolo & Goodwyn, 1988; Rowe, Ozcaliskan, & Goldin-Meadow, 2008) and sign language, as a language (e.g., American Sign Language—ASL) as used by those in the Deaf community as mentioned previously. Since then, the field has become somewhat divided by studying naturally occurring gestures (Acredolo & Goodwyn, 1988; Rowe & Goldin-Meadow, 2009a, 2009b; Rowe et al., 2008; Sauer, Levine, & Goldin-Meadow, 2010; Vallotton & Ayoub, 2010; Vallotton, 2009) and teaching and studying signs as an intervention or means to enhance one's communication skills, as taken from a commercialized product or from ASL (and other sign languages; Petitto, Holowka, Sergio, Levy, & Ostry, 2004; Pizer, Walters, & Meier, 2007; Tincani, 2004; Vallotton, 2010; 2011a; 2011b; 2012).

Many years of research has been conducted on children when they are communicating within the intentional communication stage, with primary interest on their gesture use (e.g., Acredolo & Goodwyn, 1988, 2000; Broaders, Cook, Mitchell, & Goldin-Meadow, 2007; Thal & Tobias, 1992; Vallotton, 2010, 2011b). According to previous research (Thal & Tobias, 1992), the frequency of gesture production in childhood is a reliable predictor of later vocabulary development. Vallotton (2010) conducted a study on typically developing infants that showed the use of gestures may actually predict the child's ability to produce infant signs, the intervention of interest for the current study.

This culmination of research proves especially relevant for the current study since the target population of young prelinguistic hearing children with diagnosed language delays are already considered developmentally behind their typically developing counterparts in the area of language skills. Therefore, introducing infant signing to this population of children may in fact enhance their communication skills and may promote their current skill level to that similar of a child without a language delays.

Benefits of Infant Signing

Prior research has shown many benefits of using infant signs in many areas of development with both typically developing children and children with delays or disabilities. By reviewing the literature on how infant signing has helped typically developing children as well as a few groups of children with specific disabilities, the need for future research on using signs with children who have been diagnosed as having a language delay is made more evident. As seen in Table 1, *Overview of Intervention*

Studies, the 18 total peer reviewed articles resulting from a current literature review on the topic show articles reporting on children with and without disabilities. These studies have been categorized by intervention and non-intervention studies in order to highlight the need for intervention studies on this topic, per the asterisk denotation by the non-intervention studies. As seen in Table 1, of the 18 total studies included in the current literature review, 12 of those report the results from an infant sign language intervention (Brereton, 2008; Daniels, 2004; Goodwyn et al., 2000; Gongora & Farkas, 2009; Harding et al., 2011; Kirk et al., 2013; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2008a, 2012). Table 1 also include six additional studies that report findings of studies conducted on infant sign language or sign language that was already ongoing within the setting studied (DiCarlo et al., 2001; Howlett et al., 2011; Vallotton, 2009, 2010, 2011b; Wijkamp et al., 2010). Of the total 18 studies, six out of 12 of the intervention studies (Harding et al., 2011; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2012) and two out of six of the non-intervention studies (DiCarlo et al., 2001; Wijkamp et al., 2010) included results on children with disabilities, totaling only eight total studies found focusing on children with disabilities. Twelve of the 18 studies report on intervention and non-intervention studies with children who are typically developing, without any identified delays or disabilities.

Children without any diagnosed disabilities or delays, otherwise known as typically developing children, have been the target population for most infant signing intervention studies. In the last few decades, most researchers have focused on showing potential developmental gains by these children in the areas of language and social-

emotional skills. These studies have occurred in the homes and child care/ education settings with a varying age range of children participating from very young infants to middle schoolers (Brereton, 2008; DiCarlo et al., 2001; Goodwyn et al., 2000; Howlett et al., 2011; Kirk et al., 2013; Vallotton, 2008a, 2011b).

Benefits of infant signing with typically developing children. As seen in Table 1, 12 of the 18 studies were identified in the literature review as reporting results on infant signing with typically developing children (Brereton, 2008; Daniels, 2004; DiCarlo et al, 2001; Goodwyn et al., 2000; Gongora & Farkas, 2009; Howlett et al., 2011; Kirk et al., 2013; Vallotton, 2008a, 2009, 2010, 2011b). For typically developing children, most of the developmental benefits seen in research are found in the developmental area of language and communication or social emotional skills.

Developmental benefits in the language domain for typically developing children recorded in recent research include an increase in verbal language skills in the classroom when a signing intervention is implemented in the classroom by the teacher (Brereton, 2008; Daniels, 2004; DiCarlo et al., 2001; Harding et al., 2011; Tincani, 2004; Toth, 2009; Vallotton, 2008a, 2009, 2010, 2011b; Wijkamp et al., 2010), in the classroom by a primary caregiver (Thompson et al., 2007), in the home when implemented by the primary caregiver (Gongora & Farkas, 2009; Goodwyn et al., 2000; Tait et al., 2004; Toth, 2009; Vallotton, 2012), and in community-based primary caregiver signing classes (Howlett et al., 2011; Kirk et al., 2013). These results suggest that infant signing may be beneficial to young children's language skills whether implemented in the home by primary caregivers or within a school or community setting.

DiCarlo et al. (2001) carried out their study to ease the minds of the primary caregivers with children in child care centers receiving infant sign interventions. The primary caregivers had voiced concerns that their children may not develop expressive language skills on time because of infant signing. The misunderstanding of infant signing was put to rest when the researchers were able to show the primary caregivers the results of the study, which showed no decrease in verbalizations, but rather an increase in the total communicative acts by each child. These results were similar across both groups of children, those with and without disabilities. On the contrary, Daniels (2004) showed a positive correlation between children receiving a signing intervention and the receptive language skills, when tested at a later point. Daniels studied 41 kindergarten age children, half of which participated in a sign enriched classroom with a teacher trained in the use of sign language. Her results suggest that, while there were no significant results for children's expressive language, there were significant results for their receptive language. It can be inferred from these data that children's understanding of the sign language intervention (e.g., their receptive language skills) developed before their ability to express these newly acquired skills (e.g., their expressive language skills). This is promising evidence of the effectiveness of sign language with young children.

Similarly, Goodwin, Acredolo, and Brown (2000) showed that typically developing toddlers whose primary caregivers encouraged language development through infant signing, had slightly elevated receptive and expressive language skills than their peers whom did not participate in the infant signing. When taken together, these results

not only show the benefits of using infant signing with typically developing children, but also the ease of use for both the home and the classroom setting.

Another benefit of infant signing with typically developing children is found in social and emotional development. These benefits include increased social skills (Goodwyn et al., 2000; Thompson et al., 2007) as well as an appreciation for diversity (Brereton, 2008).

In Goodwyn et al.'s (2000) study, typically developing toddlers and their primary caregivers showed decreased frustration levels after the signing intervention took place, indicating the intervention allowed for better communication between the child and the primary caregiver. Similar results were seen in Thompson et al.'s (2007) study. Thompson and colleagues (2007) taught infant signs to young children ages 6 to 10 months of age. The infants in this study showed an increase in signing after intervention that carried across multiple, untrained settings. These same infants also showed less crying and whining behaviors after learning the infant signs.

According to Brereton (2008) the use of sign language in preschool classrooms helps typically developing children and their teachers develop a sense of cultural diversity and appreciation for other communication methods than speech alone. In Brereton's (2008) study, preschool teachers taught sign language (not infant signing) to a classroom of hearing preschoolers as an additional way to communicate and found that children and teachers alike were having more discussions about diversity within the classroom afterwards. In addition, the children and teachers were able to communicate

with each other during quiet times in the classroom and in the hallway, by means of their new communication tool.

Additionally, a study by Vallotton (2008a) suggests that preverbal infants and toddlers are able to use infant signs in order to better express their current emotions and/or feelings with adults. This study took place within an early childhood setting in which the teachers were trained on how to use infant signs throughout their daily routines. The teachers were instructed to embed the signs within their lessons and activities but not to "instruct" the children but rather to model the signs for them. A later study conducted by Vallotton (2009) suggests that parental responsiveness was positively correlated with an increased amount of child gestures and signing, however the signing elicited the most responsiveness.

More recent research found that the use of infant signing by a mother with her typically developing child increased her maternal responsiveness to her infants' nonverbal cues and increased the mother's encouragement of the child's independence (Kirk et al., 2013). In this study ($n = 40$), half of the mothers were trained to use specific "symbolic gestures" or infant signs with their infants between the ages of eight and 20 months. The mothers in the intervention group were taught five object signs (i.e., tangible objects such as "food") and five non-object signs (i.e., abstract concepts such as "more"). The results of this study suggest that infant signing did not actually increase the communication skills of the children in the intervention group, however the mother's responsiveness to their children in this group increased, showing an increased frequency of encouraging dependent actions toward the child as well increased responses to their

infants' non-verbal cues. Similar to Vallotton's (2009) data, signing has shown to be a potential elicitor of parental responsiveness.

Another study conducted in Chile by Gongora and Farkas (2009) supports the previous claims as well. These researchers studied 14 typically developing infants' ages five to nine months old and found that once introduced to a signing intervention, the infant and the mother showed an increased amount of visual and tactile interactions.

Finally, a study conducted by Howlett et al. (2011) was conducted in order to investigate the results of signing interventions and programs on parental stress. Howlett and his colleagues conducted surveys on 178 mothers of infants and toddlers who currently attended community based primary caregiver signing classes. Their results show that mothers participating in the sign language classes had higher stress scores prior to beginning the classes and may have been attracted to the sign classes because of the advertised benefits (e.g., decreased stress). However, no data suggest that parental stress was a result of attending the sign classes.

Together these 12 studies provide meaningful data on the implications of signing interventions. Both language and social-emotional benefits are positively correlated with children receiving infant signing interventions. These benefits are significant for all children and families, and may possibly have similar results for children with disabilities.

Benefits of infant signing with children who have disabilities. In addition to typically developing children, recent studies have shown that infant signs are beneficial to children with disabilities as well. During a recent review of the literature, only eight empirical studies were found that reported original results on young prelinguistic hearing

children with disabilities in an infant signing intervention program, as seen in Table 1, *Overview of Studies*. From these articles, four main disability categories resulted. These include: (a) neurological disorders such as Cerebral Palsy (DiCarlo et al., 2001; Tait et al., 2004) and Autism and Pervasive Developmental Disorder- Not Otherwise Specified (PDD-NOS) (DiCarlo et al., 2001; Tincani, 2004; Toth, 2009); (b) intellectual disabilities such as Down syndrome (DiCarlo et al., 2001; Thompson et al., 2007; Toth, 2009) profound and multiple learning disabilities (Harding et al., 2011), Fetal Alcohol Syndrome Disability (Toth, 2009); (c) children at risk for developmental delays (Vallotton, 2012); and (d) language disabilities (Wijkamp et al., 2010). In the following discussion, research conducted on these four categories of disabilities (i.e., neurological disorders, intellectual disabilities, at-risk children, and language disabilities) is further examined as well as a brief review of the importance of and the need for future research in the area of language delays.

The first disability category with previous research on infant signing includes children with neurological disorders such as Cerebral Palsy (DiCarlo et al., 2001; Tait et al., 2004), Autism (DiCarlo et al., 2001; Tincani, 2004; Toth, 2009), and PDD-NOS (Tincani, 2004). According to the National Institute of Neurological Disorders and Strokes (2013), Cerebral Palsy is a term referring to a group of neurological disorders occurring in infancy or birth that permanently affects an individual's physical abilities. Because young children begin communicating by using prelinguistic behaviors consisting of primarily gestures and other bodily movements (McCauley & Fey, 2006), it may be considered difficult to communicate with these children via infant signing. However,

research has shown the opposite. A study by Tait et al. (2004) showed that primary caregivers are able to enhance the communication skills of their children with Cerebral Palsy by communicating with them in infant signs. Although these children have motor disabilities that may prevent them from functioning as a typically developing child, all of the children in the study were able to perform approximations of the infant signs as modeled to them by their primary caregivers.

Similar results were seen in another study (DiCarlo et al., 2001). In DiCarlo et al.'s study, children with Cerebral Palsy needed many physical prompts when the infant signs were first introduced to them. Over time, the need for the prompting decreased while the children became more and more able to perform the sign approximations more independently. Although none of these children were using the exact infant signs taught to them, the meaning of the sign between the child and their caregivers was meaningful, therefore serving the purpose of the sign intervention.

Children with the neurological disorder Autism have also been researched relating to infant signs. According to the Autism Society of America (2006), Autism is a complex developmental disability that results from a neurological disorder and effects development in the areas of social interaction and communication. Because of the difficulty with communication, research has focused much time and effort on learning the best way to communicate for and with children with Autism. Some recent researchers have focused their attention on using infant signs with this population (DiCarlo et al., 2001; Tincani, 2004).

Similar results were found when Tincani (2004) compared the use of a Picture Exchange Communication System (PECS) with infant signing with a group of two students with Autism. Tincani's results show that both children were able to use infant signs fairly easily although one of the two children had more difficulties due to her comorbid motor impairments.

The second disability category with previous research on infant signing includes children with intellectual disabilities. According to the National Dissemination Center for Children with Disabilities (2011), the term intellectual disability, also called cognitive disabilities or mental retardation, is used when an individual has developmental limitations in their mental functioning and in other areas such as language, self-help skills and social skills. As described by IDEA (34 CFR §300.8(c)(6)), intellectual disabilities are defined as ". . . significantly subaverage general intellectual functioning, existing concurrently with deficits in adaptive behavior and manifested during the developmental period, that adversely affects a child's educational performance." Intellectual disabilities can include learning disabilities, Fetal Alcohol Spectrum Disorder (FASD), chromosomal abnormalities such as Down syndrome, as well as injuries resulting from accidents such as brain lesions (National Dissemination Center for Children with Disabilities, 2011). No formal studies meeting the inclusion criteria for the current literature review were found to include children with brain lesions, so this topic is not discussed.

One type of intellectual disorder includes those that are genetically driven. Down syndrome is the most well known and most researched biologically based intellectual disorder (Polloway, Patton, & Nelson, 2011). All children diagnosed with Down

syndrome experience mild to moderate cognitive delays (National Down Syndrome Society, 2012) and often have restricted attentional capacity (Clibbens, Powell, & Atkinson, 2002). These children also experience more difficulty with their communication skills because of the intellectual disabilities and motor impairments (Bird et al., 2005). Because of the comorbidity of the impacted developmental areas, many researchers have attempted to find the most efficient way for those with Down syndrome to communicate with others.

Multiple studies have found infant signing with children who have Down syndrome may increase social skills (DiCarlo et al., 2001; Thompson et al., 2007; Toth, 2009), communication skills (Thompson et al., 2007; Toth, 2009), has been shown successful in inclusive classroom settings (DiCarlo et al., 2001), and can be used successfully by primary caregivers (Thompson et al., 2007; Toth, 2009). DiCarlo et al. (2001) found infant signing with children with Down syndrome enhanced their communication efforts as much as typically developing children. Their research also showed an increase in vocalizations paired with their signing, increasing from 20% to 24% after implementation. Results found by Thompson and colleagues (2007) suggest that signing can be used for children with Down syndrome as a means to decrease the amount of crying and whining as well as serve to increase their intentional communication skills via signing with a caregiver.

Another study by Harding et al. (2011), reveals results from two 6-year old children with profound and multiple disabilities, another type of intellectual disability. According to the World Health Organization (1993), this term is given to individuals with

profound cognitive impairments as well as multiple physical, sensory and/or health related disabilities. Harding and colleagues found that after selecting signs from words that were motivating to the children, both children needed fewer physical prompting to make the hand movements for the signs. The children showed more expressive language abilities when signing during play time by requesting and rejecting objects and one of the two children responded more frequently to his name when called. Social skills were also enhanced after the sign intervention. Both children began making more eye contact, as well as vocalizing and signing/gesturing more often. Finally, both children also showed behavioral gains as well. After the sign intervention, one of the children showed fewer food refusals, made more eye contact, and showed fewer signs of stress when communicating such as crying and shouting.

Children with other intellectual disabilities such as Fetal Alcohol Syndrome Disability (FASD) have also been studied using infant signs. Toth (2009) showed children ages zero to six years old with FASD video recordings of someone presenting sign language in either American Sign Language (ASL) or French sign language (LSQ) as well as the spoken word for a list of vocabulary words. According to Toth, the researcher then told the primary caregivers and teachers to be creative in how they present the vocabulary to the students within the next month. What Toth found was hearing children with disabilities such as learning disabilities and FASD showed language benefits from using the signing intervention but unfortunately no specific data was shared.

The third disability category with previous research on infant signing includes children who may be at-risk for developmental delays. Not only children with specifically diagnosed disabilities may benefit from infant signing. Rather, children with developmental delays, those under three years who have not been diagnosed yet with a more severe disability, or those considered to be at-risk for developmental delays, with biological or environmental factors that may cause them delays in the future (IDEA Part C § 303.5) have also been studied with infant signing interventions. Vallotton (2012) studied 29 toddlers from low income homes and their families. Her results suggest that infant signing may reduce parent related stress in mothers, promote more positive communication between the child and primary caregiver, increase attunement of mothers to their children's' affect and distress cues, and increase mothers' positive views of their children. In addition, these results suggest that not only is infant signing helpful in low income households, but also that it is a feasible intervention method for this type of family. Unfortunately, no other studies could be found on at-risk children learning infant signing.

Finally, little research has also been conducted in the fourth disability category, speech and language disabilities and delays. One study conducted by Wijkamp et al. (2010), examined eight children under five years old with language impairments. Wijkamp and colleagues (2010) studied Dutch speaking children's use of Dutch sign language to facilitate communication within their classroom settings. The findings of this study show that the majority of the children used naturally occurring gestures often but rarely did they use signs. This single study is not enough to credit or discredit the use of

infant signing with children who have language disabilities. The study reports on a case study, where the children observed were already experiencing signing and gesturing as part of their daily classroom experiences. Not enough is known about the methods used by the teachers to implement the signing program.

By reviewing the past research on using infant signs for hearing children, it is made apparent that more research is needed on this topic. Although many benefits have been found for children with and without delays or disabilities, very few studies have been conducted on children who are considered to be "at-risk" for developing later disabilities (Vallotton, 2012) or for those with diagnosed language delays or disabilities (Wijkamp et al., 2010). The current study focused on using infant signs in the home with young, hearing children via a primary caregiver-implemented infant signing intervention.

Family-Child Interaction

Because primary caregivers are their children's first teachers, it is obvious the relationship between the family and the child is important for all aspects of the child's development. According to Cook et al. (2000), the level of adult responsiveness to their child's communication is one of the most important characteristics for facilitating the most ideal language development. Research also suggests that infants benefit from the information primary caregivers scaffold to them, even if subconsciously, by adapting their language and behaviors to better meet the child's current developmental level (Tamis-LeMonda, Kuchirko, & Song, 2014). Specifically, maternal responsiveness may predict many early language milestones in typically developing children such as a child's first imitations, first words, and discussing past events (Tamis-LeMonda, Bornstein, &

Baumwell, 2001). However, for families of children with language delays, these skills may be delayed, thus creating the need for outside assistance from professionals. One of the most important factors that influence family-child interaction includes the support the family receives from outside the household such as early intervention professionals and community agencies and how those professionals promote family involvement.

Promoting a Family-Centered Approach

Much research has focused on how agencies and service providers can best support the important role the family has in preparing their children with disabilities for achieving their highest developmental potentials. The focus on the key role and responsibility of the family with regards to young children is often referred to as a "family-centered approach" (Allen, 2007; Dunst, 2002; Dunst & Trivette, 1989; Hansuvadha, 2009; McWilliam et al., 1995). According to Dunst (2002), family-centered practices have the following six characteristics: (a) treat families with dignity and respect; (b) create practices that are individualized, flexible, and responsive; (c) share information so that families can make informed decisions; (d) encourage family choice regarding program practices and intervention options; (e) encourage primary caregiver–professional collaboration and partnerships; and (f) provide/ mobilize resources and supports necessary for families to care for their children (p. 141).

When professionals, such as frequently visiting early intervention professionals, interact with primary caregivers and children, being able to refer to the characteristics of a family-centered practice model is helpful in order to promote the most positive and supportive parenting skills. This is especially true for families who have children with a

language delay or disability, which may prove frustrating to many families, as the children may not be able to clearly communicate his wants and needs with caregivers.

According to McWilliam (2011), the most common mistakes providers usually make when working with young children with disabilities and their families can be resolved by working more collaboratively with the primary caregivers. Similar to the characteristics discussed earlier in Dunst's (2002) definition of family-centered practices, this resolution is based on the professionals' respect and acknowledgement of the family's unique understanding of their child. This approach assumes the primary caregiver has the child's best interest in mind and by viewing the professional as a partner, the primary caregiver is given encouragement and guidance when making important decisions for their family.

Family involvement is crucially important to all aspects of a child's development, especially for children with language impairments (Wilcox & Woods, 2011). Wilcox and Woods (2011) describe an early intervention approach in which the family's participation is priority during speech-language pathology home visits. This approach supports the Vygotskian approach discussed earlier because of the support given by the primary caregivers to the child, as the learner. This approach also meets criteria set forth by Part C of the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA Part C §303.12(b)), which stipulates that all services provided for infants and toddlers in the early intervention program (i.e., under three years of age) must be family centered and occur in the child's natural environment.

Conceptual Model

By incorporating the previously discussed theoretical framework with the researcher's personal interests, and topical research, the conceptual model (Figure 2) was created (Ravitch & Riggan, 2012). As stated by Maxwell (2013), a conceptual framework is not simply a literature review or something that "exists ready-made," rather it is a construction that requires a critical examination of previous literature, theoretical lenses, and personal experiences (p. 41). The following conceptual model (Figure 2) attempts to construct such a critical examination on the current topic of infant signing for young, prelinguistic hearing children with diagnosed language delays. As discussed earlier, according to Wood et al. (1976), the learner (i.e., the child) gains new skills by way of scaffolding by the adult or other more advanced learners in his/her environment. This process can be seen within the central most area of the model presented in Figure 2, titled "ZPD" for zone of proximal development (Vygotsky, 1978). On the left side of the model, the oval titled "current skills" represents the level of communication the child is able to do without assistance, while on the right side of the model, the oval titled "potential skills" represents the communication skills the child is currently unable to grasp but may be able to in the future. Therefore, the central most section, where the two large ovals cross can be viewed as the ZPD, where the child's current skills develop into what were once his potential skills.

What is distinctive about this conceptual model is section titled "ZPD in natural learning environment." This is seen in the larger, lighter gray intersections the two larger ovals make and can be viewed as a cross reference between Vygotsky's ZPD, scaffolding

(Wood et al., 1976) efforts during the learning process, and Rogoff's (2014) perspective of learning occurring most efficiently within the natural learning environment, also mentioned previously. Within the current study, the ZPD can be viewed as the amount of learning a child with diagnosed language delays may make during any language/communication intervention, while an adult is scaffolding higher level skills for them. However, the larger grey intersection represents more potential learning when these interventions (i.e., infant signing) occurs within the child's natural environment and is incorporated into their usual daily routines, rather than during specified teaching moments.

The current study employed the previously discussed conceptual model by viewing the participating children's current skills as those described by the primary caregiver during the pre-intervention data collection measures. Eligible child participants' current skills included having no current knowledge of infant signing and fewer than five spoken words, at the time the study began. The participating children's potential skills were viewed as the verbal and/or manual skills each child learned during the infant signing intervention. The zone of proximal development was viewed as the progression of the child's communication skills from having no verbal or signing communication attempts (i.e., current skills) to potentially showing progress by using verbal or signing communication (i.e., potential skills) with the assistance of the primary caregiver throughout the infant signing intervention. By conducting the intervention in the child's home, the current study attempted to decrease the difficulty between the

child's current skills and potential skills by providing the intervention in the child's most natural environment (Rogoff, 2014).

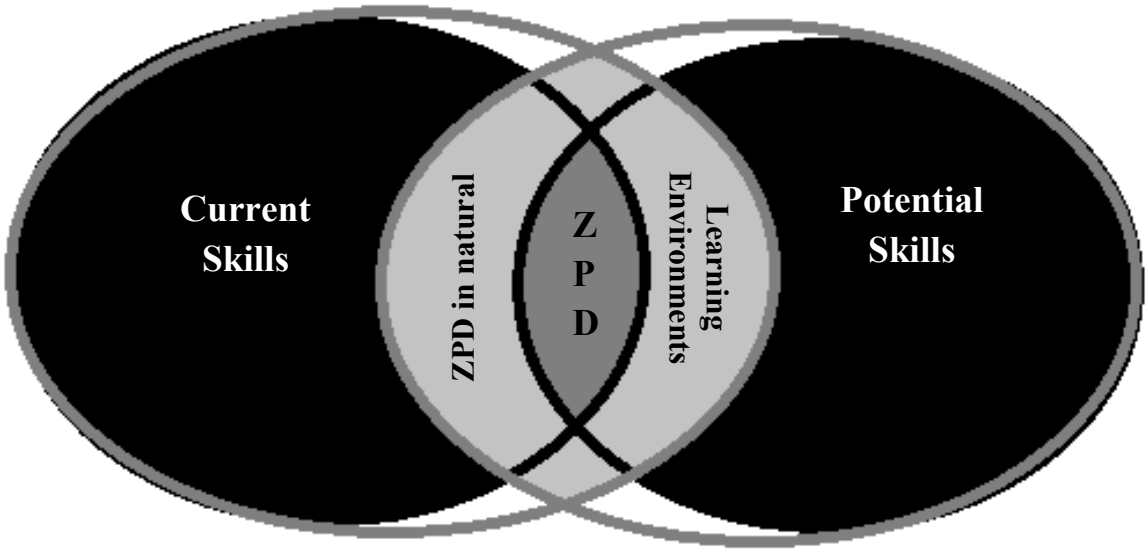

Figure 2. Conceptual Model.

Potential Contribution of the Current Study

The study utilized a single subject, multiple probe methodology (Gast & Ledford, 2010). This design was selected as a direct result of reviewing the literature on the study's topic, revealing two major needs in the focus area: stronger research methodologies and more research showing the effects of infant signing on children with diagnosed language delays.

There is a large literature base on the success of using infant signs with children with specific disabilities (DiCarlo et al., 2001; Lal, 2010; Perez et al., 2001; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2012; Wijkamp et al., 2010). According to a literature review conducted by Johnson et al. (2005), there have

been multiple studies conducted with both hearing and non-hearing primary caregivers of young hearing children learning infant signs or gestures. Out of the 17 studies they reviewed between 1980 and 2003, there was little support to the claim that signing advances a child's development. However, the review did note the reasons behind this failure of support for infant signing may be related to the many methodological weaknesses in the studies reviewed. According to Johnson et al. (2005), there were "no examples of randomized-controlled trials in the published literature. The two prospective quasi-experimental research programs lacked adequate comparison groups, had small sample sizes and poor follow-up" (p. 243).

One of the "quasi-experimental studies reported by Johnson et al. (2005), includes a study funded by the National Institute of Health and conducted by Goodwyn et al. (2000). According to Goodwyn et al. (2000), an increase occurred in the amount of vocabulary used by children via signs. However, this study also points out the lack of strong methodologies during the study itself, such as not controlling for confounding variables such as differences in primary caregiver sign trainings and carryout, eye-to-eye contact between the adult and the child, and duration of communication (e.g., talking, signing, singing, laughing, caressing, etc.) between adult and child.

A more recent study conducted by Kirk and colleagues (2013) did not find a difference in language outcomes when comparing children whose mothers received gesture directions, formal sign directions, and verbal directions to use with their preverbal children. In this study, mothers were given a "training packet" rather than verbal directions during a face-to-face training by a researcher and were told to use the signs or

gestures "as frequently as possible." However, no explicit directions on how many times per day to use the sings or gestures as a minimum were given. Additionally, no daily data were collected by the mothers or the researchers regarding how often the signs were modeled or how many times the child responded or used them spontaneously. Rather, bi-monthly interviews were conducted to collect these data.

The current study addressed these gaps by utilizing a single subject multiple probe methodology across participants which consisted of a primary caregiver implemented signing intervention (Gast & Ledford, 2010). As stated previously, few studies have shown meaningful results when using strong methods. Many studies have provided results of infant signing as a direct result of an intervention study (Daniels, 1996a, 1996b, 1997; DiCarlo et al., 2001; Gongora & Farkas, 2009; Goodwyn et al., 2000; Iacono & Duncum, 1995; Kirk et al., 2013; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2011b, 2012; Yoder & Layton, 1988; Yoder et al., 2001) or have shown the results of an infant signing class or the use of gestures already in process at the time of the study (Brereton, 2008; Fidler et al., 2005; Howlett et al., 2011; Perez et al., 2001; Petito et al., 2004; Pizer et al., 2007; Vallotton & Ayoub, 2010; Wijkamp et al., 2010). However, few studies have focused an intervention on communication skills for children with language delays (Vallotton, 2011c).

The primary caregiver-implemented and primary caregiver report aspect of the current study was also unique. Although many primary caregivers use infant signing with their typically developing children as well as children with delays or special needs, few studies (Daniels, 1997) have followed, and provided detailed intervention guidelines

for parent use. The current study provided both a primary caregiver training which introduced the primary caregiver to the signs and how to use them, as well as the steps needed to take, and a reminder Primary Caregiver Handout to use with their child on a daily basis. This study used data taken daily by primary caregiver report on their children's sign and/or spoken language attempts in addition to the regularly taken researcher data.

The current study adds to the current literature on infant signs by focusing not only on young children with diagnosed language delays but it also employed strong research methodologies. The majority of previous studies on this topic have focused on larger samples of children of varying ages and abilities but few have used a single subject approach (DiCarlo et al., 2001; Thompson et al., 2007; Tincani, 2004). This approach allowed for more in depth data collection than the larger experimental studies (Acredolo & Goodwyn, 1988; Brereton, 2008; Daniels, 1993; DiCarlo et al., 2001; Fusaro & Vallotton, 2011; Gongora & Farkas, 2009; Goodwyn et al., 2000; Howlett et al., 2011; Kirk et al., 2013; Perez et al., 2001; Pizer et al., 2007; Toth, 2009; Vallotton, 2011b, 2012, Wijkamp et al., 2010; Yoder & Layton, 1988; Yoder et al., 2001) but also allowed for more prescribed and structured methodologies than the small case studies (Iacono & Duncum, 1995).

By using a single subject multiple probe methodology, the current study builds on previous literature by replicating the design across participants to establish external validity, by providing "at least three demonstrations of experimental control at three different points in time" to establish experimental control, all while allowing for the

testing of effects under typical home environment setting the children are more comfortable in (Horner et al., 2005, p. 174).

Additionally, the single subject approach identifies a functional relationship between the independent and dependent variables by using visual analysis. Visual analysis is the traditional approach to analysis used by many single subject researchers which involves the interpretation of the level (i.e., phase), trend (i.e., rate of increase or decrease), and variability (i.e., degree of behavior fluctuation) of performance or behavior being measured during both baseline and intervention conditions (Horner et al., 2005).

The multiple probe design allowed for intermittent pre-intervention data (baselines) to be collected rather than continuous data as seen in the multiple baseline design. In addition, this design allows for individualization of the words chosen per family, which ensured the signs/words chosen for each participating child are motivating to that particular child (Gast & Ledford, 2010; Harding et al., 2011). Utilizing the multiple probe design also allowed a signing intervention to occur without the need for withdrawal, as seen in many applied A-B-A-B designs (Gast & Ledford, 2010). Lastly, the level of detail needed for this type of methodology will allow for easier replication in future studies.

In addition to the single subject methodology, the study was comprised of a pre-post-intervention procedure (Gast & Ledford, 2010) using an adapted short form of the MacArthur Communicative Developmental Inventory (CDI), which included the Gestures section from the long form of the same instrument (C. Vallotton, personal

communication, February 19, 2015; Fenson et al., 2007). This version was adapted in order to capture both the current language skills in a brief format as well as the child's current natural gestures (C. Vallotton, personal communication, February 19, 2015). The adapted CDI short form was used in order to show similarities or differences between single subject results and those typically administered by school systems, and served as a means to collect data for the A-B, or pre- post-intervention (Gast & Ledford, 2010) portion of the study. This approach provided a comparison of potential language and gesture changes to be measured via a well-known language inventory.

Conclusions

Infant signing with young hearing children who have diagnosed language delays is a topic that has not been given much thought in previous research. However, it warrants future research, as indicated by the many benefits research has shown for similar groups of children. Infant signing has shown beneficial results for typically developing children in the areas of social-emotional development and language skill development. Additionally, infant signing has shown varying benefits for children with disabilities such as those with neurological disorders, intellectual disabilities, and children at risk for developmental delays.

By viewing the previous research and the potential implications for children and their families through a historical perspective of the benefits of using infant signs with other groups of children, both typically developing and those with delays or disabilities, as well as through a Sociocultural Theoretical perspective, one is able to see the potential

impact on child outcomes. The current study adds to the research by providing much needed data on this topic.

CHAPTER III

METHODOLOGY

This study utilized a multiple probe single subject experimental design across three child participants and their primary caregivers. In addition, a child language inventory was given to the primary caregivers prior to and following the intervention. In this chapter, an overview of the research methods, followed by a description of the settings and materials are discussed. Next, the characteristics of the child and primary caregiver participants are presented. Threats to internal and external validity are then presented as well as how the researcher attempted to control for these threats. Finally, a brief summary of the data analysis methods followed by the conclusion of the chapter.

Overview of the Method

The purpose of this study was to investigate the use of infant signing to enhance the communication skills of young hearing children with diagnosed language delays, as indicated on their Individualized Family Services Plan (IFSP). The following research question was addressed: What is the effect of a primary caregiver-implemented infant signing intervention on the frequency of spontaneous and prompted communication attempts, as measured by spoken, signed, or both modalities, for young hearing children with diagnosed language delays when implemented within the child's natural environments and during natural scenarios?

Primary caregivers received training to implement the infant signing intervention with their child in their home environment on a daily basis. For clarification purposes, the variables are referred to by the name of the measurement tool. The variables, design, and intervention will now be described in more detail.

Dependent Variables

The first dependent variable was the number of prompted communication attempts (spoken, signed, or both) made by the child, per day, to communicate the selected needs and wants. Prompting always included the primary caregiver providing a verbal and manual sign for the target word/ sign to the child. The second dependent variable was the number of spontaneous (i.e., unprompted) communication attempts (spoken, signed, or both) made by the child, per day, to communicate the selected needs and wants. In order to collect daily data, primary caregivers intentionally prompted each word/sign a minimum of five times per day for each of the three identified words/signs. The primary caregivers were also instructed to record any additional spontaneous child initiated communication and level of prompting implemented throughout the day as well as any spontaneous attempts by the child to request any of the three identified items. The dependent variables were measured by the single subject study, as described below.

Single subject observation protocol. Data collection was taken on the number of signs/ words by the researcher during baseline and by both the researcher and the primary caregiver during intervention. The primary caregiver recorded daily each of the intervention signs/words and the social routine in which that sign/word intervention took place using the *Single Subject Observation Protocol* (Appendix A). This observation

form was used by the researcher during the baseline stage as well as by the primary caregivers during the intervention phase to record the daily data produced as a result of the intervention being implemented within their home. This observation form is described in greater detail in the upcoming methods section.

The reliability and validity of this measure were both evaluated as part of this study. According to Gast and Ledford (2010), researchers using single subject designs traditionally determine the reliability of the measure (*Single Subject Observation Form)* via interobserver agreement.

Inter-observer agreement (IOA) of child data was taken during the weekly 15-20-minute play sessions, for a minimum of 25% of data collection sessions. The primary caregiver was asked to complete "environmental manipulation," a teaching procedure (Gast & Ledford, 2010, p. 70) that ensures the child will have an opportunity to use each one of the three signs while the researcher was there while attempting to make the session and prompting as natural as possible for the child. When the child had the opportunity to use the sign, the primary caregiver was instructed to use the prompting strategy outlined in the training. The researcher then collected data on the observations of the primary caregiver-child interactions during intervention sessions on the same *Single Subject Observation Protocol* (Appendix A) the primary caregivers use. The researcher's observation protocol was then compared to the primary caregivers' protocol.

IOA was collected on 25% of the data sessions (Horner et al., 2005). Out of those, an agreement of 80-100% was required. If this goal was not met, the primary caregiver was retrained on how to code the protocol, according to the original training

guidelines, until a minimum of 80% agreement occurs (Horner et al., 2005). The IOA was calculated by the number of agreements over the total number of data collection points taken by the researcher. If IOA dropped below 80% agreement, disagreements were discussed and the primary caregiver was retrained on each item, as necessary. By the end of this process for each family a 100% level of negotiated agreement between the coding by the second coder and the researcher was reached using the formula below (Miles & Huberman, 1994): Reliability = number of agreements/(total number of agreements + disagreements).

Participants

Child Participants

A total of three children participated in this primary caregiver-implemented intervention study. Children who participated in this study met the following inclusion criteria: (a) 12-36 months of age; (b) currently participating in the North Carolina Infant-Toddler program (NC ITP); (c) has a current Individualized Family Service Plan (IFSP) with at least one language related outcome; (d) currently speaks no more than five words; (e) has a diagnosed speech/language delay; (f) does not have any other diagnosed disabilities; (f) has never been introduced to infant signing or sign language; and (g) is not receiving speech therapy. Because of the extreme difficulty of the recruitment process and the narrow eligibility criteria set by the researcher, the last criterion was dropped in order to recruit the third and final family. It was concluded that these families were difficult to reach for multiple reasons, which may have included: already being exposed to sign language at childcare or at home; already participating in speech therapy

or not willing to put speech therapy on hold for the duration of the study; and/or having multiple areas of disability. Finally, children attending a childcare center outside of the home were considered as well as those who stayed at home with the primary caregiver, however, childcare status was noted.

Child 1 was a 17-month-old male who was previously diagnosed by the NC-ITP as having language delays on his Individualized Family Service Plan (IFSP) and was identified as "bi-racial" on the demographics survey by his legal guardian/grandmother. At baseline, Child 1 was speaking three words, as reported by his grandmother. These included "Daddy," "doggie," and "baby"; however, the grandmother also reported he did not seem to make a connection with the word "Daddy" rather saying it without meaning. To have his needs met by caregivers, Child 1 would point, grunt, babble, and cry if not understood. He did not use any signs for communication.

Child 2 was an 18-month-old male who lived at home with his foster mother and three other foster siblings. His legal guardian/foster mother identified him as an African American who had been previously diagnosed with language delays on his IFSP by the NC-ITP. Child 2 did not speak any words at baseline but would indicate his wants and/or needs by grunting, whining, crying, or screaming. He did not use any signs for communication.

Child 3 was a male African American child. He was 12 months old and lived at home with his biological mother and father. He was also diagnosed by the NC-ITP as having language delays. Child 3 was an only child and did not use any spoken words or signs to communicate with others at baseline. He was the only child who had previously

received speech therapy. While in the study, Child 3 was evaluated by an Occupational Therapist and a Psychiatrist for Autism Spectrum Disorder but both professionals agreed that he was not on the spectrum. During the home visits, however, the researcher and mother discussed the lack of eye contact and that the child consistently attempted to grunt and babble with his lips and mouth fully closed. In order to have his needs met, this child would babble and grunt with closed lips, point, and pull the adult by the hand in the direction he wanted to go. Child 3 received speech-language therapy once a week for approximately one hour, however, this only occurred in the child care center setting The mother reported that his primary speech language goals were to communicate verbally with his caregivers. The mother reported that speech therapy occurred 3-4 times and only within the setting of his child care center. Therapy was canceled one month prior to entering the study.

Primary Caregiver Participants

Participants also included the primary caregiver/legal guardians of the child participants. Primary caregivers were asked to identify the caregiver who spends the most time with the child participating in the study, totaling a minimum of five hours per day spent in the same physical space (e.g., home, community) as the child. Other inclusion criteria for the primary caregivers were: (a) living in the same home with the child full time, (b) English speakers, and (c) 18 years of age or older at the time of recruitment. Primary caregivers who worked outside the home were considered as well as those who stayed home with their child(ren) during the day. All children and primary

caregivers/ legal guardians resided in the triad area of North Carolina at the time of this study.

Relevant characteristics of primary caregiver participants are listed in Table 2. Information is provided on ages of the primary caregiver at baseline, gender, current age in years, marital status, education level, and annual family income (see Table 2). Primary caregiver 1 was self-identified as the child's grandmother/ legal guardian. She was 44 years old, Caucasian, married, and held a bachelor's degree. She reported the annual family income as between $70,000 and $80,000. Primary caregiver 2 was self-identified as the child's foster mother/ legal guardian. She was 43 years old, African American, single, and held a master's degree. She reported the annual family income as between $50,000 and $60,000. Primary caregiver 3 was self-identified as the child's biological mother. She was 37 years old, African American, married, and held a bachelor's degree. She reported the annual family income as above $80,000. This information is summarized in Table 2. None of the participating primary caregivers had participated in a research intervention prior to this study.

The researcher obtained all informed primary caregiver consent using the format approved by the Institutional Review Board (IRB) at the University of North Carolina at Greensboro (UNC-Greensboro). The informed consents were signed and returned before participants began the study and before any data were collected.

Table 2

Characteristics of Primary Caregiver Participants

Primary Caregiver	Relationship to Child	Gender	Age	Race	Marital Status	Highest Education	Annual Family Income
1	Grandmother/ Legal Guardian	Female	44 years	Caucasian	Married	Bachelor's Degree	$70-80,000
2	Foster Mother	Female	43 years	African American	Single	Master's Degree	$50-60,000
3	Biological Mother	Female	37 years	African American	Married	Bachelor's Degree	Above $80,000

Setting

The study took place in the children's living areas within their homes, as this allowed for the most natural environment, which is required for all state services by Part C of the Individuals with Disabilities for Education Improvement Act of 2004 (IDEIA, 2004). No other criteria were required of the family's home environment. The primary caregivers were asked by the researcher to ensure each of the prompted words/signs were completed within the same setting in similar situations daily for each of the three words/signs. Spontaneous attempts occurred at any point and at any setting throughout the day (home or community).

An additional setting was used for the generalization data collection, during the researcher's final visit. This setting was selected by the primary caregiver as a secondary natural environment for the child. The generalization settings included a great-grandmother's home, a family friend's home, and a nearby restaurant that was frequently visited by the family and child.

As seen in Table 3, the household members residing with Child 1 consisted of both grandparents/legal guardians and the child participant. However, during the majority of the researcher's visits to the home for data collection purposes, the grandmother and child were the only ones present. The grandfather was sometimes present and the child's aunt was present when home from school, though she did not reside in the same household. Both grandparents, the child participant, and the great-grandmother (owner of the home) were all present during the generalization visit, including the researcher.

Table 3

Characteristics of Settings

Child	Home Setting	Generalization Setting	Household	Target Words/ Signs
1	Living Room at Home	Great-grandmother's Home	Grandparents/ legal guardians, Child	Eat, Ball, Book
2	Living Room at Home	Friend's Home	Foster mother, three foster siblings, child	Drink, Ball, Book
3	Living Room at Home	Table at frequently visited restaurant	Mother, father, child	Drink, Mickey Mouse, Book

The household members residing with Child 2 included the foster mother, three foster siblings, and the child participant. During the researcher's home visits, the foster mother and child participant were always present, however the remaining three foster children were only sometimes present. During the generalization visit, all four children, the foster mother, and the family friend (owner of the home) were all present including the researcher.

The household members residing with Child 3 included both biological primary caregivers and the child participant. All three family members were present in the home during each of the researcher's home visits. The mother and child participant were the only ones present during the generalization visit. All home and generalization setting information for all three families is summarized in Table 3. The primary caregiver training sessions also occurred within the home setting after baseline and before intervention data were collected.

Materials

The manual signs identified to be taught for each students where those that related to actions and/or items identified as highly motivating for the child (e.g., ball). All materials used during the primary caregiver training sessions with the researcher were those actual items that would be used with the child during intervention. These same items were then used by the primary caregiver when prompting the child to request each item daily via manual sign and/or verbally. Items identified as highly motivating and used during the study, as well as the corresponding ASL signs can be seen in Table 3. During the primary caregiver training sessions, the primary caregivers were instructed by the researcher to always use the same physical object when prompting the child to request verbally and/or via manual sign. As seen in Table 3, the signs were all very similar across the three families. This is further discussed in Chapter 5.

Measures

Single Subject Observation Protocol

The five codes indicated in each column include: "Sign," which means the child produced the sign only, and not the word; "Word," which means the child produced the word only, and not the sign; "Both," which means the child produced both the sign as well as said the word; "Approx," which means that either the sign and/or word was approximated by the child; and "N/R" for "No Response," which means the child did not attempt the sign or the word or seemed uninterested. The primary caregivers were then asked to give a brief explanation beside each entry on the data form. For example, if the child responded to the primary caregiver by attempting to make a similar hand motion

and babbling the boxes for "both" and "approx." would be checked and the primary caregiver's written explanation could be, "child attempted to make sign and babbled."

On the back of each *Single Subject Observation Form*, the researcher also took anecdotal notes (Billingsley, 2004) about the environment (e.g., people present, time of day, current activities, meals, and layout of room) during each of the home visits. This information was used after the study to determine potential environmental factors for similar or different results among participating families.

Supplemental Measures

In addition to the primary data collection measure, the *Single Subject Observation Protocol*, the current study also included four supplemental measures in attempt to collect all data needed for a thorough research methodology. As seen in Appendices B through E, the secondary data collection measures included a:

1. *Child Language Inventory*
2. *Demographics Survey*
3. *Social Validity Survey*
4. *Primary Caregiver Exit Interview*

These are all discussed in detail below.

Child language inventory. In addition to the primary measure of progress, the single subject intervention and observations, all primary caregivers participating in the study were also asked to complete an adapted version of the *MacArthur Communicative Developmental Inventory (CDI): Short Form*, *Level I,* as well as the *Gestures* portion of the long form of the same instrument (C. Vallotton, personal communication, February

19, 2015; Fenson et al., 2007; see Appendix B). This inventory was handed to the primary caregivers prior to baseline. The CDI (Fenson et al., 2007) is a communication inventory primary caregivers complete on their children in order to inform primary caregivers and others (in this case the researcher) about their young children's language and communication skills. Collecting this language data prior to baseline assisted the researcher and the primary caregiver in making decisions of which signs/words will be the most motivating for the child. This data was also compared before and after the intervention as another measure of whether the child's language skills did or did not improved over time.

The *CDI: Short Form, Level I* (Fenson et al., 2007) is recommended to be used with children between 8 and 16 months of age. However, because of the study focus on children diagnosed with language delays, this particular inventory was chosen as a best fit because it assesses earlier language skills than the later inventories offered. When using this inventory for children outside of the originally intended age range, the developers of this inventory suggest comparing their raw scores to that of a median child, or the 50th percentile level for a child of another age. This 50th percentile level then serves as the age equivalency for the participating child. The *CDI: Short Form, Level I* contains an 89-word vocabulary checklist rather than the 555 items included by the entire inventory. This shorter form also takes less time, as it takes less than 10 minutes to complete whereas the entire inventory takes approximately 20 to 40 minutes, depending on the child's skill level as well as the primary caregiver's level of understanding. Fenson and

colleagues (2007) suggest the short forms be used by researchers "who are 'seeking' a quick assessment of early language" (p. 14).

The *CDI: Short Form, Level I* form is said to have "reliable indices of vocabulary development that are highly correlated with vocabulary scores on the full CDIs" (Fenson et al., 2007, p. 13). The *CDI: Words and Gestures* has a reported test-retest reliability ranging from .9 to 2.37 months, with an average test-retest lag of 1.35 months (Fenson et al., 2007). Pearson correlation values (*r*) between test and retest scores for vocabulary comprehension ranged in the upper .80s when computed separately for each month. Correlations for vocabulary production was low in the 8–10-month range but stabilized to the mid .80s in subsequent months. Correlations for gesture scores were also in the .80 range for most months. The predictive validity ranges with correlations from .60 to .80 when predicting productive vocabulary at 20 months to vocabulary and grammar at 29 months (Fenson et al., 2007).

Demographics survey. Participants were asked to fill out a brief *Demographic Survey* (Appendix C) during the researcher's first visit to the home before the intervention began. The *Demographic Survey* included the following sections: (a) child's information; (b) primary caregiver's information; (c) secondary caregiver's information; and (d) household information. Items on each of these sections were designed to obtain descriptive family data.

Items on section one "child's information" asked primary caregivers to provide information on 10 items including: child's name, address, phone number, birthdate, age, gender, and race. Items on sections two and three: "primary caregiver's information" and

"secondary caregiver's information," respectively, asked primary caregivers to complete information on eight items each including: the caregiver's name, relationship to the child, highest education levels, birthdate, primary language spoken, marital status, and race (U.S. Department of Education, National Center for Education Statistics, 2007) as well as current health conditions (e.g., depression, anxiety, schizophrenia, other). Items on section four, "household information" asked primary caregivers to complete information on five items including: to identify the number of children and adults living in the household, their relationships to the child, the annual family income level, and to indicate whether the family has access to internet at home and if they have received any financial benefits from any government agencies (U.S. Department of Education, National Center for Education Statistics). The entire *Demographics Survey* consisted of 31 total items.

Social validity survey. Primary caregivers completed a brief *Social Validity Survey* before and after the intervention comprised of five statements (Appendix D). This survey served as a tool to ensure the families involved were interested in the intervention and to measure their thoughts on the feasibility and value of the intervention in supporting their child (Wolf, 1978). The survey used a 5-point Likert scale, as suggested by Gast and Hammond (2010), (i.e., 1 = *strongly disagree* to 5 = *strongly agree*) to indicate the primary caregivers' response to each of the following statements:

1. I think using signs with my child will help me better understand his/her wants and needs
2. I think using signs with my child is a good approach to enhance their communication skills

3. I will carry out the signing intervention as it is taught to me
4. Using signs with my child will be a manageable goal for our daily activities
5. I will refer other primary caregivers to use signs with their children.

Primary caregivers also provided a brief explanation of each response. According to Gast (2010), opinion surveys are an acceptable strategy for obtaining "consumer satisfaction data" or social validity data when conducting single subject research design investigations (p. 102).

Primary caregiver exit interview. After all intervention data were collected, the researcher then conducted one last interview with the primary caregivers (*Primary caregiver Exit Interview*, Appendix E). The purpose of this interview was to inform future research in this area as well as to serve as a secondary social validity measure for the study. The primary caregiver was asked questions regarding their experiences during the study, potential benefits of the intervention, and suggestions for the future.

Procedures

This study utilized a single subject design to demonstrate a functional relationship between the use of infant signs and the expressive language skills of young children with language delays. Specifically, the design was a multiple probe across three participants (Gast & Ledford, 2010). Because of recruitment difficulties, the third child began baseline after the first two families completed the intervention, therefore a delayed baseline design was used to include the third child. During baseline, the three children were observed by the researcher in the child's home while interacting with the primary caregiver. The three motivating words/signs were previously decided on by the

researcher and the primary caregiver. Using these identified words/signs, the researcher probed each child a minimum of five times until data were stable for three sessions (e.g., child did not vocally or manually produce any of the three identified words/signs), as suggested by Horner and colleagues (2005). Following baseline, the primary caregiver sign training began for family 1. Each primary caregiver received a one-hour primary caregiver sign training with the researcher in which the primary caregiver had to master each of the three signs, while vocally stating the name for each sign simultaneously. Primary caregiver sign training continued until the primary caregiver reached 100% mastery for each of the three identified words/signs to be used with her child. After showing mastery, each child-primary caregiver dyad was given one week to practice the new intervention. The primary caregiver would introduce the three signs/words to the child on day one and begin subsequently on day two with the intervention, as taught to her during the training session. One week after the primary caregiver sign training session the researcher completed the first fidelity check and inter-observer reliability. The primary caregiver began collecting daily data at this point as well.

In addition, pre- and post-intervention data was also taken via the language inventory (Appendix B). Primary caregivers completed this primary caregiver-reported language inventory on the child's current language and gestural skills prior to and after intervention. Primary caregivers also completed a pre- and post-Likert scale *Social Validity Survey*. The completion of the primary caregiver exit survey was a secondary measure of social validity.

The current study included the recruitment of participating families, explanation of consent to participate, a detailed primary caregiver sign training completed by the researcher, and different phases of data collection. These are all discussed in more detail below.

Recruitment

The researcher originally recruited four families with hearing children between 12 and 36 months old who were diagnosed with a language delay and currently receiving North Carolina Early Intervention services. A snowball or chain sampling strategy (Creswell, 2007) from local childcare centers and via word of mouth was also implemented in order to satisfy the sample size. According to Creswell (2007), this type of sampling allows the researcher to identify participants from people who know other people that may meet the selection criteria. *Recruitment Fliers* (Appendix F) describing the study distributed to local early intervention agencies as well as child care centers and personal contacts. The staff receiving these fliers were asked to give the fliers to the families receiving their services that may fit the participant selection criteria. Potentially eligible families were also given *Consent to Contact* forms (Appendix G) from their child care providers, Children's Developmental Services Agency, or other community agency representatives serving children and families. Interested families completed the *Consent to Contact* form and returned it to the person or agency from which they received the flier then shared the form with the researcher. *Recruitment Fliers* were also posted to the researcher's personal Facebook page.

The researcher collected the forms and made the first phone call to the interested families. During the initial contact, the researcher described the study and intervention to the primary caregiver, answered any questions they may have had, and conducted the *Phone Recruitment Interview* (Appendix H) which is described below to ensure the family and child met all eligibility criteria for the study. During this phone call, the first home visit was also scheduled.

Phone recruitment interview. During the initial phone call between the interested primary caregiver and the researcher, the researcher asked the primary caregiver the questions on the *Phone Recruitment Interview* (Appendix H). These questions were created in order to determine eligibility of the primary caregiver and child for the current study. Questions were designed so that certain answers would flag the family for ineligibility. The interview included four questions about the primary caregiver and questions about the child. Questions about the primary caregiver included:

1. Do you speak English?
2. Do you spend at least five hours per day with your child?
3. Do you live in the same home as your child?
4. Are you at least 18 years old?

Questions about the child included:

1. Is your child between 12 and 36 months of age?
2. Is your child in the North Carolina Infant Toddler Program?
3. Does your child have a written Individualized Family Service Plan (IFSP) with at least one language related outcome?

4. Does your child have a diagnosed speech/language delay?
5. Does your child currently say any words?
6. Does your child have any other diagnosed disabilities?
7. Has your child ever been introduced to infant signing or sign language?
8. Is your child currently receiving speech therapy?

As stated earlier, the last question regarding speech therapy was not asked of the third family. This phone interview helped avoid the recruitment of families that may not meet the eligibility requirements, as well as to avoid unnecessary time disrupting the family's daily routines. The first home visit by the researcher was also scheduled during the initial phone call.

Researcher's First Home Visit

During the first home visit, the researcher completed six tasks with the primary caregiver:

1. completed the *IFSP Review Form* based on viewing the child's current IFSP
2. explained and have the primary caregivers sign the *Consent Forms*
3. asked the primary caregiver to complete the *Demographics Survey*
4. collected the *Social Validity Survey*
5. collected the child language inventory, the *MacArthur Communicative Developmental Inventory (CDI): Short Form*, as well as the *Gestures* portion of the long form of the same instrument

6. asked the primary caregivers to identify three to five words (e.g., items in the child's home environment) that he/she believed would be beneficial for the child to learn how to say/sign

First, the researcher asked to see the child's current Individualized Family Services Plan (IFSP), per the primary caregiver's approval on the *Consent Form* (Appendix G). The researcher then used the *IFSP Review Form* (Appendix J) to serve as an additional means to ensure the family's eligibility for the study, which will include section's one, two, and four of the child's IFSP. Information from section one of the *IFSP Review Form* included the child's name, date of birth, date of referral, initial IFSP date, IFSP start date, and the date of any interim IFSP meetings. Information from section two included the current IFSP participants and/or team members, the family's areas of concern, and the priorities of the family. Information from section four included the language related outcomes as well as the related six-month goals, current functioning levels, methods and strategies for completing the goals, and the start and end dates for each goal.

Second, all families were given a copy of the full, University of North Carolina at Greensboro (UNCG) Institutional Review Board (IRB) approved *Consent Form* (Appendix I) during the first face-to-face meeting in the home with the researcher. The researcher reviewed the *Consent Form* and answered any questions about the study before requesting their signed *Consent Forms*. All *Consent Forms* were completed before any data was collected on children or primary caregivers and the participants received a copy of the consent form for their records. All remaining documents collected during the researcher's first home visit have been described in detail in previous sections.

In subsequent home visits, the researcher discussed the results of the *Child Language Inventory*, the three targeted signs/words with the primary caregiver that will be used in the study with the child, and conducted the primary caregiver sign training. During all home visits following the primary caregiver sign training the researcher collected single subject data on the child as well as procedural fidelity data on the primary caregiver's implementation of the study. These procedures are all described in more detail in the following section, "Data Collection."

Primary Caregiver Sign Training

Primary caregiver sign training began after at least five baseline probes were taken for their child, however the timing differed for each participating family depending on their order of entry within the study. The researcher used the *Procedural Fidelity Checklist A: Primary caregiver Sign Training* (Appendix K) when training each primary caregiver to ensure each primary caregiver was trained similarly. This process is summarized below.

Sign training was completed by the researcher with the primary caregiver after the three signs/words were decided on. The targeted signs/word were based on what the primary caregiver felt would be most motivating and interesting for the child to learn (Tait et al., 2004) and would be the most beneficial for the child in terms of getting his/her wants and needs met. This information was also guided by the results of the *Child Language Inventory* (Appendix B). The three signs/words were all tangible items in the child's regular natural environment, or "object signs," as identified by Acredolo and Goodwyn (1988, p. 452).

The training session taught the primary caregiver how to implement the intervention with the child during the entire study as well as how to introduce the child to the signs during the first day of the intervention. During the training session, the researcher taught the primary caregiver how to create the manual sign for the chosen words with the primary caregiver repeating the signs. Each sign was also shown to the primary caregiver on the website www.handspeak.com in order to ensure the correct manual production of the sign in American Sign Language (ASL) was taught.

The researcher then ensured the primary caregiver reached a level of mastery for each of the three signs by modeling the sign for the primary caregiver while vocally stating the item's name and asking the primary caregiver to repeat both. The primary caregiver was asked to demonstrate each word/sign both manually and vocally at least three times in order to achieve "mastery." The primary caregiver was told that if any of the three chosen signs were difficult for a child to produce, an approximation of the sign would be accepted as a request from the child.

Once the primary caregiver reached mastery for each sign, the researcher then instructed the primary caregiver on how to introduce the signs to their children beginning with making sure the items were in the child's current environment. The researcher then modeled for the primary caregiver how to show the item to the child and say, "Look, here's your ____" while simultaneously signing the word. The primary caregiver was asked to repeat this process. If the child reached for the item, the primary caregiver was instructed to give the child access to the item for a short period of time (i.e., 10-20 seconds) or the child should be allowed to have a small amount of the item if it is food or

drink (i.e., a few sips of a drink or one bite sized piece of food). However, if the child did not reach for the item, the primary caregiver was instructed to introduce the next word/sign to the child. This process was repeated until the child observed the primary caregiver manually create each sign at least once. Then sign training with the child could begin, as carried out by the primary caregiver.

After the child was introduced to each of the signs, if the child spontaneously produced either a vocal or manual correct or approximated request for any of the three items at any point during the study, the primary caregiver was instructed to immediately praise the child saying, "You asked for ____! Very good! Thank you for telling me you wanted ____." The primary caregiver was instructed to give the child the item that was requested while praising the child.

However, if the child did not spontaneously produce a correct or approximated manual or vocal request for the item after given access to the item for 10 to 20 seconds or after given a small portion of it, the primary caregiver was instructed to then remove the item from the child's access for 5 to10 seconds (Thompson et al., 2007) to allow the child to have an opportunity to spontaneously request the item. If the child did not spontaneously request the item at that point (Thompson et al., 2007), the primary caregiver was then instructed to present the child with the same item again, while saying, "Do you want the ____?" while simultaneously signing the word, so the child could see the sign being produced. The sign was produced with one hand while the item was held with the other, if the sign only required one hand. If the sign required the use of both hands (e.g., "ball" or "book"), the primary caregiver would say, "Do you want the ___?"

while holding the item and immediately putting down the item in order to use both hands for creating the sign. If the child reached for the item or indicated wanting the item, the primary caregiver would then say "tell me you want the ____" while also showing the child the sign for the item. The primary caregiver would then wait another 5 to 10 seconds for the child to respond.

If the child correctly produced the sign or the spoken word, without approximations, the primary caregiver was told to praise the child immediately, saying, "You asked for ____! Very good. Thank you for telling me you wanted ____," while simultaneously signing the word each time the word is said. Then the primary caregiver was instructed to give the child the item. The primary caregiver was then shown how to record the "correct" score on the *Single Subject Observation Protocol* (Appendix A).

If the child attempted to produce the sign or the spoken word, the primary caregiver was directed to say, "Almost! Good try at telling me you wanted the ____." and then show the child by placing his/her hands over the child's hands, molding their hands in order to create the manual sign. Because the primary caregiver's praise was contingent on the wanted behavior, the child's request via spoken or manual, the primary caregiver was instructed to not praise the child after an approximation is given as the request. However, the primary caregiver was still instructed to give the child the item, after the hand-over-hand sign was demonstrated. The primary caregiver was then shown how to record the "attempt" score on the *Single Subject Observation Protocol* (Appendix A).

If the child did not respond at all after five seconds, the primary caregiver placed his/her hands over the child's hands, molding the child's hands in order to create the sign.

The primary caregiver then repeated the process of saying and signing the word. Again, because the primary caregiver's praise was contingent on the wanted behavior, the child's request via spoken or manual, the primary caregiver was instructed to not praise the child when no response is given. However, the primary caregiver gave the child the item and was directed to say, "Thank you for signing that you want the ____ with me! Next time you can tell me you want the ____ by yourself!" This provided reinforcement but not at the high level of praise received when the child correctly requests the items. The primary caregiver was then shown how to record the "no-response" score on the *Single Subject Observation Protocol* (Appendix A).

The primary caregiver was instructed to do the sign training with the child for each of the selected items five to seven times for each word, or until the child was no longer interested in the object (e.g., not looking at, reaching for, eating, or drinking the item when given access). The primary caregiver was instructed to then begin sign training in the same manner for the next item if the child shows that he is not interested in the item being trained.

After the sign training with the child was complete for each of the three words, the primary caregiver was instructed to carry on with the intervention in the same manner as was instructed during the primary caregivers sign training but without having to introduce each item, as was done on day one.

Practice sessions via role play. After the implementation process was discussed, with the primary caregiver during the primary caregiver sign training session, the researcher and primary caregiver then role played in order to check the primary

caregiver's mastery of the training. The researcher acted as the child while the primary caregiver acted as herself. Four different scenarios, as described below, were practiced: (a) the child spontaneously requesting an item; (b) the child needing prompting by the primary caregiver and then responding with a correct sign and word; (c) the child needing prompting by the primary caregiver and then responding with an approximated sign and no word; and (d) the child not responding after being prompted. The researcher checked the primary caregiver's training mastery via the *Procedural Fidelity Checklist A: Primary Caregiver Sign Training* (Appendix K) and repeated any of the four scenarios that were not passed with 100% fidelity until 100% was reached. The role play scenarios were completed with one sign/word unless 100% fidelity was not reached. In those cases, scenarios not reaching 100% fidelity were repeated with the additional two signs/words until 100% was obtained.

Throughout the intervention, any time the word was signed, the primary caregiver was instructed to reinforce the word by saying it verbally as well. This process was repeated with each of the three signs in each child's intervention daily at least five times per word, but as many times as the primary caregiver feels comfortable doing so. Additionally, the spontaneous responses from the children were recorded by the primary caregiver daily and once or twice weekly by the researcher.

The intervention occurred during natural routines within the child's home (e.g., meal time, play time, bed time, and bath time). The primary caregivers were also taught, during the sign training session, how to collect data on their child. After sign training with the primary caregiver was complete, the researcher discussed the importance of

following the procedures of the study exactly and not looking for further language or signing enhancements that are not already in the child's natural environment. It was clearly stated verbally as well in the training materials that if the primary caregiver needed support it would be given however specific requirements of the study must be followed in order to remain in the study. Neither primary caregivers nor the researcher collected data during the week following primary caregiver sign training to allow time for the family to practice the new intervention. Intervention phase data collection began one week after children were successfully introduced to each of the three signs (e.g., showing interest in the items) at least five to seven times by the primary caregiver and after each of the three signs were practiced at least five times each daily for one week.

Procedural Fidelity

Procedural fidelity data was collected in two ways by the researcher. First the researcher collected procedural fidelity on the implementation of the primary caregiver sign training on the *Procedural Fidelity Checklist A: Primary caregiver Sign Training* (Appendix K). This served as a self-assessment for the researcher to ensure consistency when training each primary caregiver. According to Wolery and Lane (2010), procedural fidelity should be measured in both baseline and intervention procedures. First, in order to establish consistent training procedures, the *Procedural Fidelity Checklist A: Parent Sign Training* (Appendix K), a 27-item checklist, was used by the researcher as a self-check when providing the sign training to each parent. The first parent training session was video recorded by the researcher. The researcher and a second observer viewed the training video and complete a fidelity checklist within one week of the parent training

session. If the fidelity was less than 80% accuracy (Horner et al., 2005), the researcher and second observer discuss the differences and the researcher would retrain the parent. The second observer would then go with the researcher to the home for the second training to conduct the fidelity in person, identifying any missed steps to the researcher as they occur. The researcher would then ensure those steps are carried out with the parent until at least 80% accuracy (Horner et al., 2005) was obtained. Because the fidelity between both the researcher and the second observer was over 80%, these steps were not necessary. Fidelity of 100% was reached between the researcher and the second observer.

Secondly, the *Procedural Fidelity Checklist B: Primary caregiver Implementation* (Appendix L) was also used during the researcher's weekly home visits, in order to document the primary caregiver's implementation of the intervention with the child. The weekly checks met the minimum requirement of 25% agreement as suggested by Gast and Ledford (2010). The researcher collected this procedural fidelity data via checklist B to identify the number of trials performed correctly by the primary caregiver (e.g., primary caregiver is correctly using the intervention guidelines). Specifically, the fidelity checks equaled 25% for child #1, 30.8% for child #2, and 33.3% for child #3.

If the primary caregiver scored less than 80% accuracy on the checklist, the researcher would conduct a "booster training" to address anything missed by the parent, until a score of at least 80% accuracy was reached (Horner et al., 2005). The "booster training" consisted of the researcher retraining the parent on the items missed until a mastery of at least 80% accuracy was reached (Horner et al., 2005), as was done in the

original "parent sign training." If the primary caregiver scored between 80 to 99% on this checklist, the researcher shared the checklist with the primary caregiver to help the parent understand the steps that were missed. This fidelity check provided data from "direct observation of how accurately and frequently" intervention procedures are used by the primary caregivers (Wolery & Lane, p. 78).

Data Collection

The current study used a delayed baseline multiple-probe across participants design (Gast & Ledford, 2010) as well as a secondary pre-post-intervention procedure using an adapted short form of the *MacArthur Communicative Developmental Inventory (CDI)* which included the *Gestures* section from the long form of the same instrument (C. Vallotton, personal communication, February 19, 2015; Fenson et al., 2007). The single subject methodology was used in order to collect thorough daily data on the child's daily communication attempts for the three identified signs/words, whereas the *Child Language Inventory* was used to collect additional data on the child's pre- and post-intervention language and gesture usage.

Single subject study components. In order to show control for each of the families' participation in the study requirements, a single subject study design with a delayed multiple probes across participants was utilized (Gast & Ledford, 2010). In order to meet the full criteria of single subject methodology, each necessary phase is described in detail below.

Baseline. The design included collecting spoken, manually signed, or both spoken and manually signed data on the first two of three children during baseline at least

five times at the beginning of the study, and until they showed a stable baseline (Gast & Ledford, 2010). A delayed baseline was implemented with the third child. This data was taken with regards to the three identified signs/words for each participating child. A stable baseline was identified for each child after the minimum of five data points were taken showing the child had no current verbal or manual skills producing the words prior to the intervention (Gast & Ledford, 2010), as indicated by the observation data recorded by the researcher. Baseline was collected for the second child while it was collected for the first child. An additional probe was conducted immediately prior to the second child's entry into the intervention. For example, after the first child started the intervention and met criterion by showing an increase in level and trend in data (e.g., an increase of at least one occurrence of either manual or verbal attempts), an additional baseline data probe was collected on the second child, via "intermittent measurement" (Gast & Ledford, 2010, p. 277) by the researcher. Because of the difficult recruitment process for this study, the third child's baseline data was not collected for the when it was collected for the first and second children. For this reason, the current study became a delayed multiple baseline in which the third child began the baseline phase after the intervention phases were complete by the first and second children.

After each participating family was determined eligible, baseline data collection began. For child 1, language and sign data was collected at least five times by the researcher on the *Single Subject Observation Protocol* (Appendix A). No data was taken during week two for any of the children. This provided a chance for child 1 to learn the new skill. Child 2 had four baseline data points collected during week one prior to

intervention, followed with one final baseline taken after child 1 received the intervention, and after child 1's data met criterion. After child 1 began intervention and showed a change in level or trend (e.g., the child showed in increase in the number of attempts of verbal or manual responses), one more baseline probe was collected with child 2 to ensure stability of baseline data. After child 2 began the intervention and met the criterion, an additional baseline probe would have been collected with child 3 prior to beginning intervention phase to assure stability of baseline data. However, this was not possible as child 3 had not yet been recruited. Data collection occurred for child 3 as it did for child 1. A total of at least five baseline data points were collected for each child participant during baseline phase, as suggested by Horner and colleagues (2005).

Intervention. During the initial *Phone Recruitment Interview* (Appendix H) with the primary caregiver, the researcher scheduled a face-to-face meeting at the participant's home in which the sign training with the primary caregiver would occur. During the initial training session with the primary caregiver, the primary caregiver and the researcher identified the three words/signs for the child to learn during the intervention. The researcher began with one word/sign at a time, teaching the primary caregiver how to replicate the sign. After the primary caregiver showed mastery in replicating the sign as indicated on the *Procedural Fidelity Checklist A: Primary caregiver Sign Training* and *Single Subject Observation Protocol* (Appendices K & A), the researcher then instructed her on how to introduce the sign to the child.

Immediately following the primary caregiver's sign training, and after the primary caregiver had mastered all three signs, the primary caregiver then began the intervention

with the child. The instructions for presenting the sign to the child included: to begin immediately, always use the sign manually, while also speaking the word to the child. This reinforced to the child that the word and the sign represent the same meaning. The researcher and the primary caregiver then role played different scenarios using the sign intervention with all three signs.

The primary caregiver was also instructed to show the child how to manually replicate the sign by "hand over hand" demonstration of each sign. The child was not neglected food or any other needed items. The primary caregiver was, however, instructed to praise the child only when he began some attempt at making the sign or vocalization of the word. The same training occurred with each of the three signs.

Using the *Single Subject Observation Protocol* (Appendix A), the primary caregivers recorded the number of independent correct signs and/or words daily. This process was practiced during the training session with the researcher and primary caregiver until the primary caregiver felt comfortable. The researcher provided multiple copies of this data collection form for the primary caregiver after primary caregiver training. Primary caregivers completed this data collection form daily for the entirety of the study.

The intervention consisted of a total of three possible signs taught to the child by the primary caregiver after the primary caregiver completed the primary caregiver sign training successfully with the researcher. All children were introduced to their three respective chosen signs (i.e., the sign intervention) after their baseline data was collected consistently for at least five data points and after demonstrating stability during baseline

(Gast & Ledford, 2010). After the primary caregiver received the primary caregiver sign training she immediately introduced the child to the chosen signs. Intervention data collection began one week after the primary caregiver sign training occurred, to allow the primary caregiver and child to practice the signing intervention together. The second family received primary caregiver sign training after the previous child's data showed an increase in level or trend, by at least one point (attempt to verbally or manually communicate any of the chosen words/signs). The third family received primary caregiver sign training after both the first two families had completed the intervention.

After the one week of practice, data was collected daily by the primary caregiver and one to two times weekly by the researcher. The primary caregiver was instructed to stop collecting data after at least five days of data were collected and at least two of those were one point higher than baseline (to control for stability). The five sessions could have included any combination of the three identified words/signs. For example, the child may have approximated the first word on day one and approximated the second word on day two. Each approximated word would constitute one data point, even though they are different target words/signs.

Maintenance. Maintenance data was collected on each of the three children at least two weeks after their intervention phase ended. This occurred in the same way as baseline and intervention data and by using the same *Single Subject Observation Protocol*. The researcher then collected maintenance data once per child at the child's home to ensure the child was still using the signs.

Generalization. Generalization data was collected at each of the three children's second natural environments, as determined by the primary caregiver, during the same week maintenance data was collected and in order to ensure the child was able to generalize their new skills to a different context. This occurred in the same way as baseline and intervention data and by using the same *Single Subject Observation Protocol*. The primary caregiver and the researcher discussed the options and decided on the second natural environment together. The settings for the generalization data collection visits included a family member's home, a close friend's home, and a nearby restaurant frequently visited by the family. This information was previously summarized in Table 3.

Supplemental data. An adapted version of the *CDI Short Form* including the *Gestures* portion from the *CDI* long form was given to the primary caregiver during the first visit from the researcher (C. Vallotton, personal communication, February 19, 2015; Fenson et al., 2007). Primary caregivers completed this one-page inventory on their child twice, once prior to baseline and once after intervention data was collected, to determine their child's receptive and expressive language skills (Fenson et al., 2007). After completion of the child's language inventory, the researcher discussed the results with the primary caregiver during the following home visit.

Controlling for Threats to Internal and External Validity

Internal Validity

Internal validity was established by a repeated systematic replication of a functional relationship between the independent variable (the primary caregiver

implemented infant signing intervention) and the dependent variables (the number of intentionally prompted and spontaneous communication attempts made by the child per day). The intervention was demonstrated with three signs/words per child and replicated across three primary caregiver-child dyads. History effects were controlled for by the use of staggered entry into the intervention across primary caregiver-child dyads. Maturation effects were controlled for through regular documentation of events and changes that may have affected the home environment, primary caregiver, and child through staggered entry into the intervention with the first two families. The third family had a delayed baseline due to the timing of entry into the study and recruitment difficulties. Procedural fidelity of 100% was also maintained for all primary caregiver sign training sessions. Instrumentation effects were controlled for by achieving 100% interobserver agreement (IOA) between the researcher and the second observer during the first primary caregiver sign training session.

External Validity

According to Horner et al. (2005), single subject studies are prone to weak external validity. However, they suggest that by including at least three participants, behaviors, or settings, in addition to multiple studies that also show replication of the independent variable (e.g., primary caregiver implemented infant signing intervention), external validity may be obtained. The current study builds on previous literature by replicating the design across participants to establish external validity. This was completed by providing "at least three demonstrations of experimental control at three different points in time" to establish experimental control, all while allowing for the

testing of effects under typical home environment setting the children are more comfortable in (Horner et al., 2005, p. 174). However, the external validity was weakened because of the late entry of the third family into the study, therefore resulting in a delayed baseline for this family.

Social Validity

Social validity data were collected in two ways to ensure the study was socially relevant and of importance to the families participating (Gast & Ledford, 2010). First, data was collected via a 5-point Likert-type scale *Social Validity Survey* asking primary caregivers questions regarding the relevance of introducing signs to their children to enhance their communication (Appendix D). The social validity survey was offered to all the primary caregivers involved in the study, both before and after implementation. Second, primary caregivers completed a *Primary Caregiver Exit Interview* (Appendix E), which served as an additional measure of social validity as well as to inform future research.

Data Analysis

During this study, the primary method of data analysis included visual analysis of the single subject data. Visual analysis is traditionally used by many single subject researchers. This method involves the interpretation of the level (i.e., phase), trend (i.e., rate of increase or decrease), and variability (i.e., degree of behavior fluctuation) of performance or behavior being measured during both baseline and intervention conditions (Horner et al., 2005). In addition to visually analyzing the single subject data, the researcher also collected supplemental data via the Child Language Inventory

(Appendix B). In addition to visual analysis, data were also analyzed by calculating the percentage of non-overlapping data (PND) for each child participant. PND is an additional outcome metric for analyzing data in single subject studies (Scruggs & Mastropieri, 1998).

Data analysis also included supplemental data collected via the *Child Language Inventory* (Appendix B). Raw scores, means, and ranges are all presented for each child in the study. In addition to these descriptive data, the researcher also compared each child's raw scores to that of the 50th percentile, therefore providing an age equivalency in which to compare the child's current language and gestural skills. These data and their separate analyses are presented in Chapter IV.

Conclusion

This study utilized a multiple probe single subject experimental design across three child participants and their primary caregivers. The purpose of this study was to investigate the effects of a parent implemented infant signing intervention on young hearing children with diagnosed language delays. In order to design a methodologically strong study, instrumentation was both designed and chosen with careful consideration to specifically capture meaningful data. In Chapter IV, the findings of the study will be discussed.

CHAPTER IV

RESULTS

In this chapter, the results of the current study are presented. The reliability and treatment integrity of the primary caregiver-implemented infant signing intervention is first described as well as a summary of how each was collected. Next, the results to the primary research question are presented. This is done by first presenting the single subject multiple probe data followed by the resulting supplemental data taken from the *Child Language Inventory*. Finally, the social validity results are discussed, in order to show relevant of the current study to the participating families.

Reliability and Treatment Integrity

Reliability

In this section the results of the interobserver agreement (IOA) will be provided overall across children and words/signs, as well as for each child. IOA is said to be strong when at least 25% of the data sessions reach between 80% to 100% agreement (Horner et al., 2005). Overall, the researcher (second observer) evaluated a mean of 30.9% of intervention data sessions collected by the primary caregivers (first observer) across all three families. Interobserver agreement was 100% for all intervention sessions observed.

For Child 1, the researcher evaluated 28.6% (two sessions out of seven) of the intervention data collected for all three words/signs. For Child 2, the researcher

evaluated 30.8% (four sessions out of 13) of the intervention data collected for all three words/signs. For Child 3, the researcher evaluated 33.3% (three sessions out of nine) of the intervention data collected for all three words/signs. Interobserver agreement was 100% for all intervention sessions observed across all participants.

Treatment Integrity

Treatment integrity for the primary caregiver sign training was self-monitored by the researcher for all three primary caregivers, as well as monitored by a second observer who completed the 73-item *Procedural Fidelity Checklist A: Primary Caregiver Sign Training* (Appendix K) in response to viewing the video recorded training of Child 1's primary caregiver. In addition, interobserver agreement of treatment integrity was collected on one of the three sessions (33%) and was reported with 100% agreement of steps completed.

Using a similar but shortened version of the previous checklist, the *Procedural Fidelity Checklist B: Primary Caregiver Implementation* (Appendix L), the researcher collected procedural fidelity of primary caregiver-implementation of the signing intervention during the study. This checklist consisted of seven detailed steps. Table 4 reports the percentage of sessions in which procedural fidelity was recorded for each child, as well as the primary caregiver procedural fidelity range and mean across words/signs. Mean Interobserver agreement is reported for sessions observed.

Table 4

Procedural Fidelity of Primary Caregiver Implementation

Child	% of sessions	Fidelity range and mean before corrections	Fidelity after corrections
1	28.6%	75-83.3% (*M=79.2%)*	100%
2	30.8%	71.4-100% (M=87.9%)	100%
3	33.3%	75-100% (M=84.3%)	100%

For Child 1, the researcher collected procedural fidelity data on two out of seven sessions (28.6%). The average procedural fidelity was 79.2% before the researcher addressed corrections needed with the primary caregiver. After corrections were made, procedural fidelity of primary caregiver implementation reached 100%. For Child 2, the researcher collected procedural fidelity data on four out of thirteen sessions (30.8%). The average procedural fidelity was 87.9% before the researcher addressed corrections needed with the primary caregiver. After corrections were made, procedural fidelity of primary caregiver implementation reached 100%. For Child 3, the researcher collected procedural fidelity data on three out of nine sessions (33.3%). The average procedural fidelity was 84.3% before the researcher addressed corrections needed with the primary caregiver. After corrections were made, procedural fidelity of primary caregiver implementation reached 100%. Although the original procedural fidelity for Child 1 and Child 2 did not meet the researcher's original definition of needing corrections (below 80%), the primary caregiver was made aware of the errors immediately in order to uphold the reliability of the study.

Results to Research Question

The following research question guided the current study:

- What is the effect of a parent-implemented infant signing intervention on the frequency of spontaneous and prompted communication attempts, as measured by spoken, signed, or both modalities, for young hearing children with diagnosed language delays when implemented within the child's natural environments and during natural scenarios?

Figure 3 provides the total number of independent (spontaneous) and prompted (primary caregiver model) correct and approximated words/signs across all three participating children. Additionally, Figure 4 provides the number of independent (spontaneous) correct and approximated words/signs across all three participating children. As suggested by Gast (2010), the multiple probe across participants design was followed for the first two participants. However, due to recruitment difficulties, the third participant began at a later time, hence the delayed baseline design for Child 3 was used. According to Gast and Ledford (2010), a delayed or non-concurrent multiple baseline, or multiple probe in this instance, may be used to "increase flexibility to include new behaviors, conditions, or participants as they become available" (p. 389).

Child 1

During baseline, data were stable and consistent. The researcher probed Child 1 during five separate data collection sessions for the three selected words/signs (i.e., "eat," "ball," "book") in order to show a stable baseline trend (Gast, 2010). The data suggest the child did not have any prior knowledge of these three target words or the manual

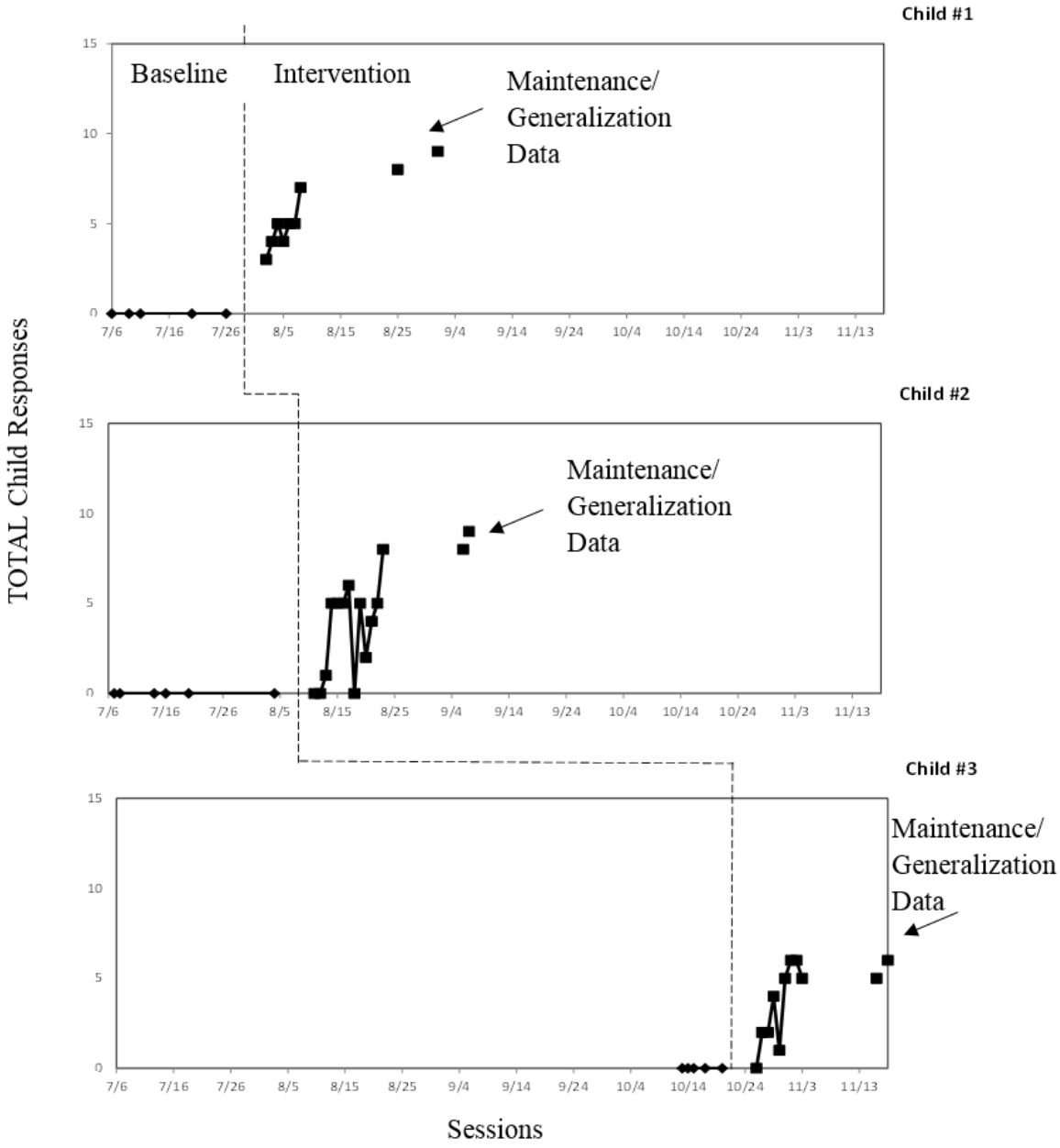

Figure 3. Total Number of Independent and Prompted Responses across Participants.

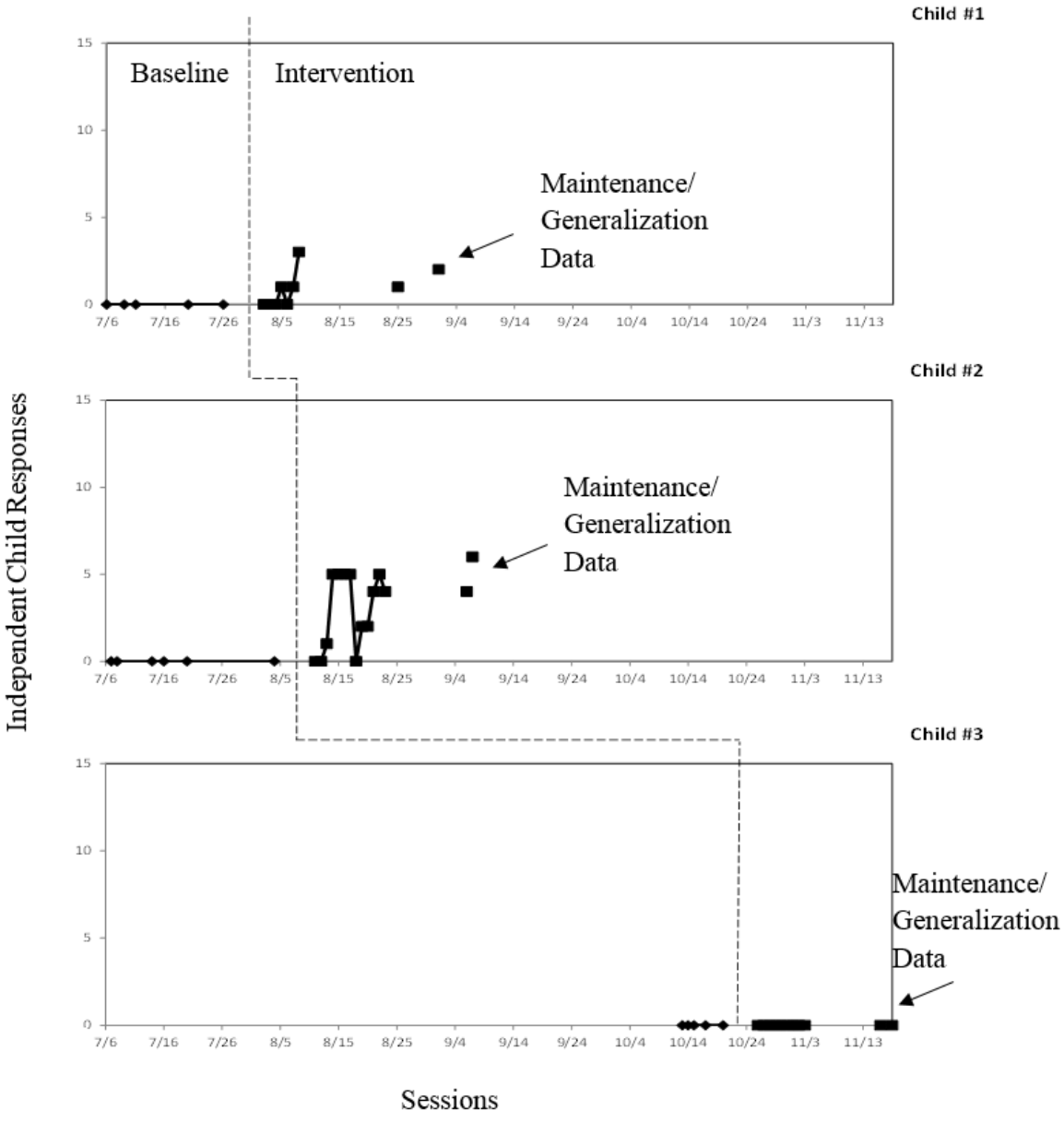

Figure 4. Number of Independent Responses across Participants.

signs associated with them. An immediate change in level and trend was observed, after introduction to the independent variable. Child 1 demonstrated an increase from baseline (M = 0) to intervention with a range of 4–7 independent and prompted responses (M = 5.3), as seen in Table 5. The child responses in Figures 3 and 4, both include the correct and approximated sign and verbal responses. The responses for Child 1 include five spontaneous correct signs (15.2%), 11 prompted approximated signs (33.3%), two prompted approximated words (6.1%), and 15 prompted correct signs (45.5%) out of 33 total verbal and/or signed responses (see Table 6). However, when looking only at the independent responses alone, he demonstrated an increase from baseline (M = 0) to intervention with a range of 0-3 independent/spontaneous responses (M = 0.7).

Table 5

Participant Mean Baseline and Intervention Scores

Child	Baseline	Intervention Range (Independent & Prompted)	Intervention Range (Independent Only)
1	0	4-7 (M = 5.3)	0-3 (M = 0.7)
2	0	0-8 (M = 3.6)	0-5 (M = 2.9)
3	0	0-6 (M = 3.4)	0 (M = 0)

Table 6

Detailed Child Response Data

	Independent/Spontaneous						Prompted						
	Approximated			Correct			Approximated			Correct			
Child	Sign	Verbal	Both	Sign	Verbal	Both	Sign	Verbal	Both	Sign	Verbal	Both	Total
1	0	0	0	5 (15.2%)	0	0	11 (33.3%)	2	0	15 (45.5%)	0	0	33
2	0	0	0	0	35 (72.9%)	1 (2.1%)	2 (4.2%)	3 (6.3%)	1 (2.1%)	0	3 (6.3%)	3 (6.3%)	48
3	0	0	0	0	0	0	31 (100%)	0	0	0	0	0	31
Total Independent/Spontaneous = 41 (36.6%)							Total Prompted = 71 (63.4%)						112

Child 2

During baseline, data were stable and consistent. The researcher probed Child 2 during five separate data collection sessions for the three selected words/signs (i.e., "drink," "ball," "book") in order to demonstrate a stable baseline trend (Gast, 2010). The data suggest the child did not have any prior knowledge of these three target words or the manual signs associated with them. A change in level and trend was observed, after introduction to the independent variable. Child 2 demonstrated an increase from baseline ($M = 0$) to intervention with a range of 0-8 independent and prompted responses ($M = 3.6$), as seen in Table 5. The child responses in Figures 3 and 4 both include the correct and approximated sign and verbal responses. The responses for Child 2 include 35 independent/spontaneous correct words (72.9%), one independent/spontaneous correct both (signs and words; 2.1%), two prompted approximated signs (4.2%), three prompted approximated words (6.3%), one prompted approximated both (signs and words; 2.1%), three prompted correct words (6.3%), and three prompted correct both (signs and words; 6.3%). See Table 6. However, when looking only at the independent responses alone, he demonstrated an increase from baseline ($M = 0$) to intervention with a range of 0–5 independent/ spontaneous responses ($M = 2.9$).

Child 3

Child 3 also demonstrated stable and consistent data during baseline. The researcher probed Child 3 during five separate data collection sessions for the three selected words/signs (i.e., "drink," "Mickey Mouse," "book") in order to show a stable baseline trend (Gast, 2010). The data suggest the child did not have any prior knowledge

of these three target words or the manual signs associated with them. A change in level and trend was observed, after introduction to the independent variable. Child 3 demonstrated an increase from baseline ($M = 0$) to intervention with a range of 0-6 independent and prompted responses ($M = 3.4$), as seen in Table 5. The child responses in Figures 3 and 4, both include the correct and approximated sign and verbal responses. The responses for Child 3 include 31 prompted approximated signs (100%) (see Table 6). However, when looking only at the independent responses alone, he did not demonstrate any growth in skills.

Overall, Child 1 produced 33 total responses, Child 2 produced 48 total responses, and Child 3 produced 31 total responses. Across all three children, 41 (36.6%) of all responses were independent/spontaneous and 71 (63.4%) were prompted by a primary caregiver (see Table 6). A functional relationship was seen between the independent variable (i.e., parent implemented infant signing intervention) and the dependent variable #1 (i.e., number of prompted child responses), but not between the independent variable and dependent variable #2 (i.e., number of spontaneous/ independent child responses).

Percentage of Non-Overlapping Data

In addition to visual analysis of the resulting data, the percentage of non-overlapping data (PND) for each participant was also calculated for both the number of total child responses and the number of independent child responses. According to Scruggs and Mastropieri (1998), PND is an outcome metric that may be used for aggregating data across studies when using single subject methodologies. To calculate PND for this study, the following steps were followed:

> (a) Determine the range of data point values of first condition . . .; (b) count the number of data points plotted in the second condition . . .; (c) count the number of data points of the second condition that fall outside the range of values of the first condition . . .; (d) divide the number of data points which fall outside the range of the first condition by the total number of data points of the second condition and multiply this number by 100. (Gast & Spriggs, 2010, pp. 215).

Generally, the higher the PND, the greater the impact the intervention (independent variable) has had on the target behavior (dependent variable; Gast & Spriggs, 2010). When looking at Figure 3, the total number of independent and prompted responses across participants, the PND was 100% for Child 1, 76.9% for Child 2, and 88.9% for Child 3. However, the number of independent responses (only) across participants, the PND was much lower for Child 1 and 3, at 42.9% and 0%, respectively (Figure 4). However, the PND remained stable at 76.9% for Child 2. According to Scruggs and Mastropieri (1998), PND scores of 70-90% are considered "effective" and scores of > 90% are "very effective." According to the data, the intervention was effective for dependent variable #1. This information is summarized in Table 7.

The intervention is considered "effective" overall when both dependent variables are taken into consideration, in the total number of child responses (both prompted and spontaneous/independent requests). However, because of the amount of overlapping data and resulting low PND for the number of independent/ spontaneous child requests, dependent variable #2 does not demonstrate effectiveness. A functional relationship was seen, however, when looking only at dependent variable #1, the number of prompted child responses.

Table 7

Percentage of Non-Overlapping Data across Participants

Child	PND for Total Number of Child Responses	PND for Independent Child Reponses Only
1	100%**	42.9%
2	76.9%*	76.9%*
3	88.9%*	0%
Mean	88.6%*	39.9%

*PND scores of 70–90% are considered "effective"
**scores of > 90% are "very effective"

Supplemental Data Results

In order to support the single subject data and to strengthen the study, supporting data were also collected. The child language inventory, the *CDI Short Form, Level I,* as well as the *Gestures* portion from the *CDI* long form, data were converted by the researcher to raw scores (Fenson et al., 2000, 2007). Raw scores are reported for each child as well as other descriptive data. Although Fenson and colleagues (2007) designated the CDI Short Form Level I as being for children between 8-16 months of age, and Level II for 16-30 month olds, the Level I form was used for all three children in this study because of their previously diagnosed language delays. As suggested by the authors, this instrument may also be used for older children with disabilities or delays (2007). Because of this adaptation permitted by the CDI authors, raw scores of the three child participants in this study were compared to the median, or 50th percentile level.

All three participating children were males, therefore the researcher used the male only normed scales when selecting the adjusted ages, based on the median for each raw

score. In the following narrative, data from the CDI Short Form, Level I are first presented, including both the "vocabulary comprehension" and "vocabulary production" scores (Fenson et al., 2007). Next, the CDI Long Form, data from the "Gestures" subscale are presented (Fenson et al., 2000). The "gestures" subscale is further broken down into two parts, "Early Gestures" which includes both "First Communicative Gestures" and "Games and Routines." Finally, data from the CDI Long Form "Section D: Pretending to be a Parent" are presented (Dale & Fenson, 1996). Within each subscale discussed, first the overall results of all three children are analyzed followed by analysis for each individual child comparing his pre and post data for that scale.

Vocabulary Comprehension

The CDI Short Form, Level I (Fenson et al., 2007) contained a brief 89-word vocabulary list in which the primary caregiver responds by checking whether their child "understands" the word or if the child "understands and says" the word. The authors then normed the two different responses as vocabulary comprehension (e.g., responding that the child only "understands") and vocabulary production (e.g., responding that the child both "understands and says"). Data from "Vocabulary Comprehension" are presented in Table 8.

Table 8

Vocabulary Comprehension Scores & Percentiles

Child		Child's Age (Mo.)	Vocabulary Comprehension		Slope	Expected Growth Obtained[2]
			Raw Score	Age Adjustment (50%)[1]		
1	Pre	17 mo.	21	13 mo.		
	Post	19 mo.	31	15 mo.	5	91%
2	Pre	18 mo.	18	12 mo.		
	Post	20 mo.	89	>18 mo.	35.5	710%
3	Pre	27 mo.	33	15 mo.		
	Post	28 mo.	32	15 mo.	-1	-143%

[1] According to the CDI User's Guide and Technical Manual, results for male children older than 18 months can be indicated by referring to the median or 50th percentile level.
[2] "Expected Growth Obtained (%) refers to the equation below comparing to the growth expected of the median child at that starting age.

Table 8 allows for comparison across children on a numerical perspective; however, in order to better visualize the actual growth each child made for each subscale when compared to the "median" child for the adjusted pre-intervention age, the slope of the two lines were compared using the equation below. As seen in Figure 5, Child 1 obtained a slope of 5 between 17 months and 19 months of age, Child 2 obtained a slope of 35.5 between 18 months and 20 months of age, and Child 3 obtained a slope of -1 between 27 months and 28 months of age. These slopes are compared to the respective "median" child's slopes for the same amount of time in Figures 6, 7, and 8.

(Slope) = [(Post Raw Score – Pre Raw Score) / (Post Chronological Age – Pre Chronological Age)]

(%) Growth Expected of Median Child = (Child's Slope / "Median Child" Slope)* 100

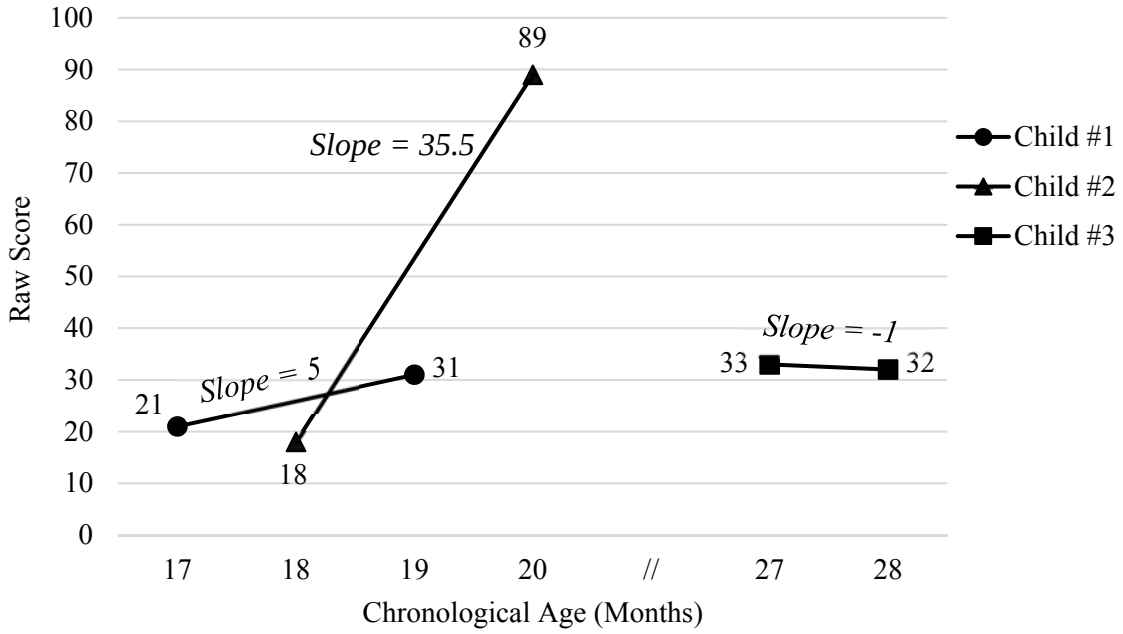

Figure 5. Vocabulary Comprehension Scores & Slopes.

Child 1. As seen in Figure 6, Child 1 met the expected vocabulary comprehension growth when comparing his post data to that of the median child for the adjusted age in which he began (13 months). This adjusted age represents the closest age in which 50% of the children score the same or higher than the raw score as Child 1 did at pre-intervention data collection. The slope for Child 1 (s = 5), is less than the slope for the median child (s = 5.5). When further analyzed by dividing Child 1's slope by the "median" child's slope, after accounting for the same amount of time (2 months), Child 1 made 91% of the growth expected of the "median" child at 13 months of age for vocabulary comprehension.

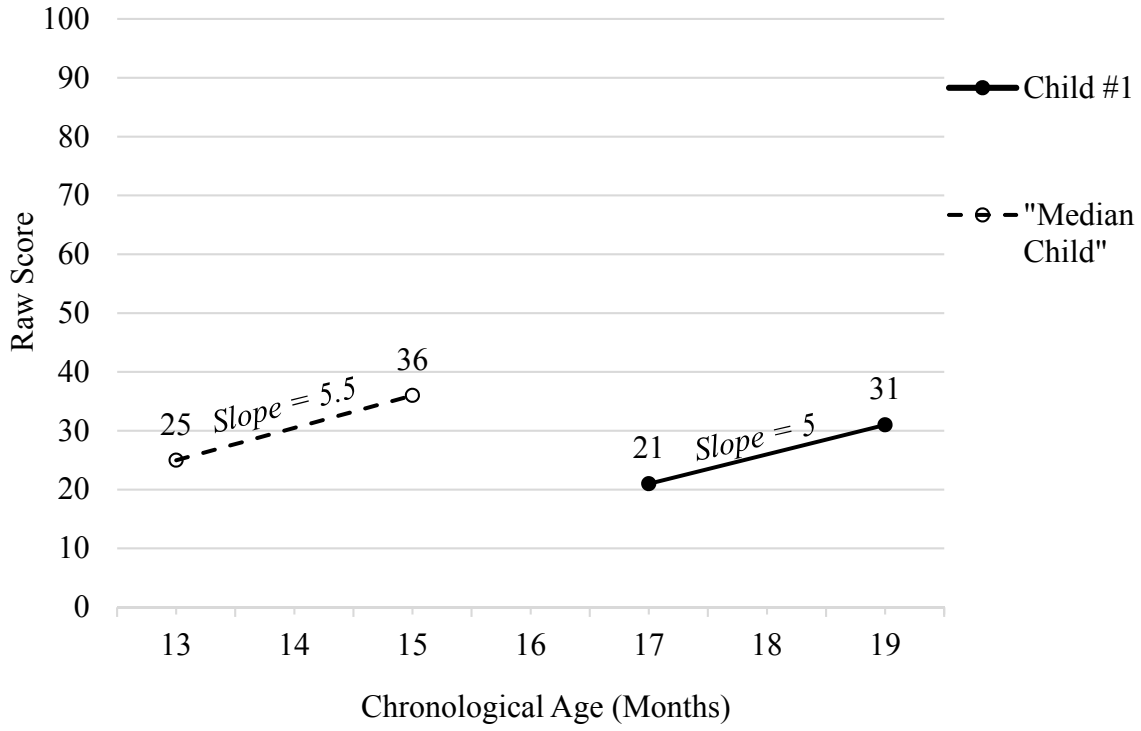

Figure 6. Child 1: Vocabulary Comprehension Growth Compared to "Mean" Child Growth.

Child 2. As seen in Figure 7, Child 2 exceeded the expected vocabulary comprehension growth when comparing his post data to that of the median child for the adjusted age in which he began (12 months). This adjusted age represents the closest age in which 50% of the children score the same or higher than the raw score as Child 2 did at pre-intervention data collection. The slope for Child 2 (s = 35.5), is larger than the slope for the median child (s = 5). When further analyzed by dividing Child 2's slope by the "median" child's slope, after accounting for the same amount of time (2 months), Child 2 made 710% of the growth expected of the "median" child at 12 months of age for vocabulary comprehension.

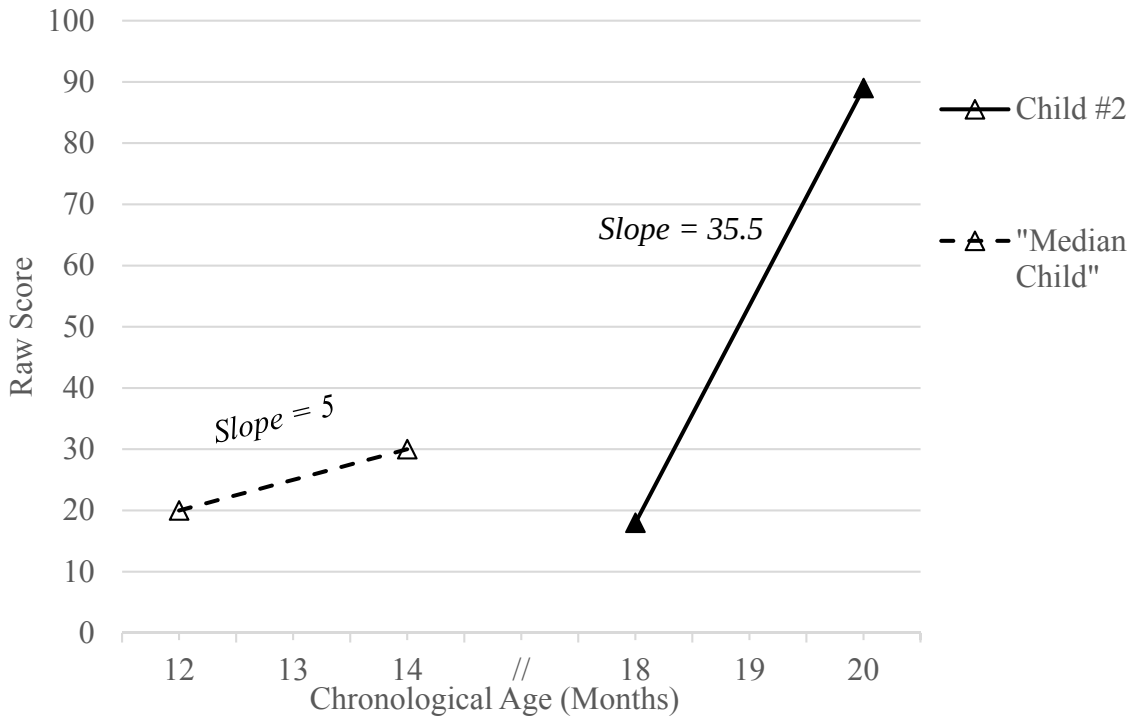

Figure 7. Child 2: Vocabulary Comprehension Growth Compared to "Mean" Child Growth.

Child 3. As seen in Figure 8, Child 3 did not meet the expected vocabulary comprehension growth when comparing his post data to that of the median child for the adjusted age in which he began (15 months). This adjusted age represents the closest age in which 50% of the children score the same or higher than the raw score as Child 3 did at pre-intervention data collection. The slope for Child 3 (s = -1), is smaller than the slope for the median child (s = 7). When further analyzed by dividing Child 3's slope by the "median" child's slope, after accounting for the same amount of time (1 month), Child 3 made -143% of the growth expected of the "median" child at 12 months of age for vocabulary comprehension.

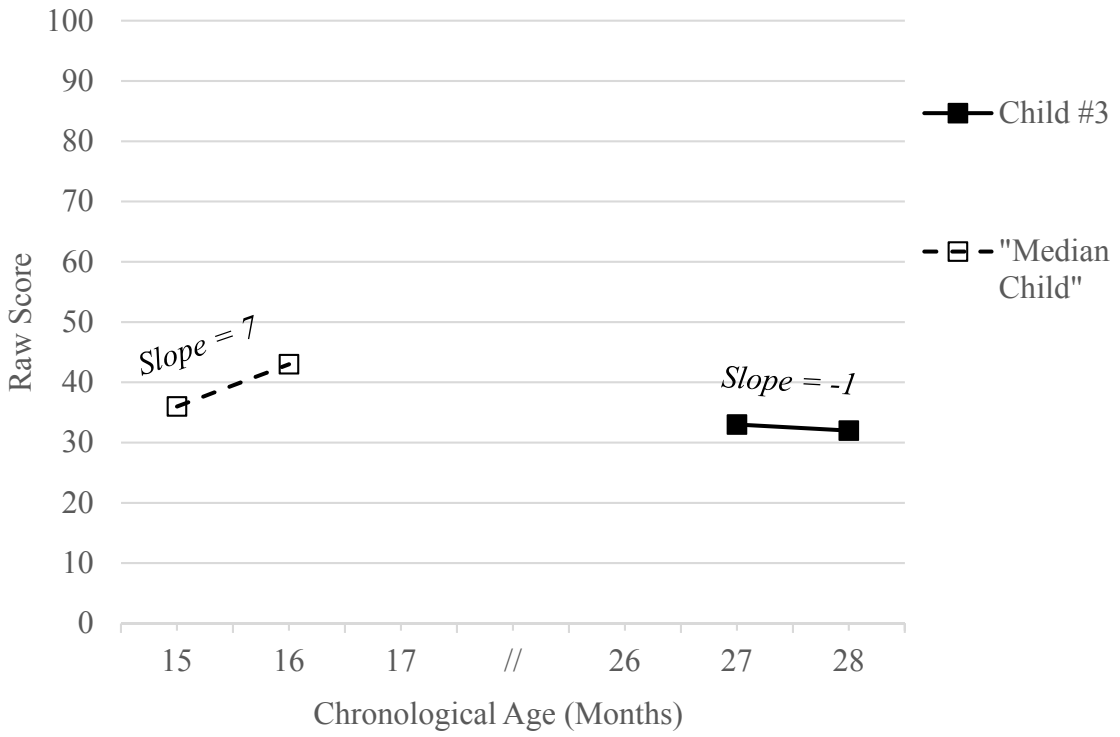

Figure 8. Child 3: Vocabulary Comprehension Growth Compared to "Mean" Child Growth.

Vocabulary Production

The authors of the CDI Short Form, Level I, normed the vocabulary comprehension (e.g., responding that the child only "understands") and vocabulary production (e.g., responding that the child both "understands and says") separately (Fenson et al., 2007). Data from "Vocabulary Production" is presented and discussed below.

Table 9 allows for comparison across children on a numerical perspective, however, in order to better visualize the actual growth of vocabulary production for each child and each subscale when compared to the "median" child for the adjusted pre-

intervention age the slope of the two lines were compared using the equation below. As seen in Figure 9, Child 1 obtained a slope of 3.5 between 17 months and 19 months of age, Child 2 obtained a slope of 5 between 18 months and 20 months of age, and Child 3 obtained a slope of 3 between 27 months and 28 months of age. These slopes are compared to the respective "median" child's slopes for the same amount of time in Figures 10, 11, and 12.

(Slope) = [(Post Raw Score – Pre Raw Score) / (Post Chronological Age – Pre Chronological Age)]

(%) Growth Expected of Median Child = (Child's Slope / "Median Child" Slope) * 100

Table 9

Vocabulary Production Scores & Percentiles

		Vocabulary Production			
Child	**Child's Age (Mo.)**	**Raw Score**	**Age Adjustment (50%)[1]**	**Slope**	**Expected Growth Obtained[2]**
1 Pre	17 mo.	1	10 mo.	3.5	350%
Post	19 mo.	8	15 mo.		
2 Pre	18 mo.	1	10 mo.	5	500%
Post	20 mo.	11	16 mo.		
3 Pre	27 mo.	0	<8 mo.	3	N/A
Post	28 mo.	3	12 mo.		

[1] According to the CDI User's Guide and Technical Manual, results for male children older than 18 months can be indicated by referring to the median or 50th percentile level.
[2] "Expected Growth Obtained" (%) refers to the equation below comparing to the growth expected of the median child at that starting age.

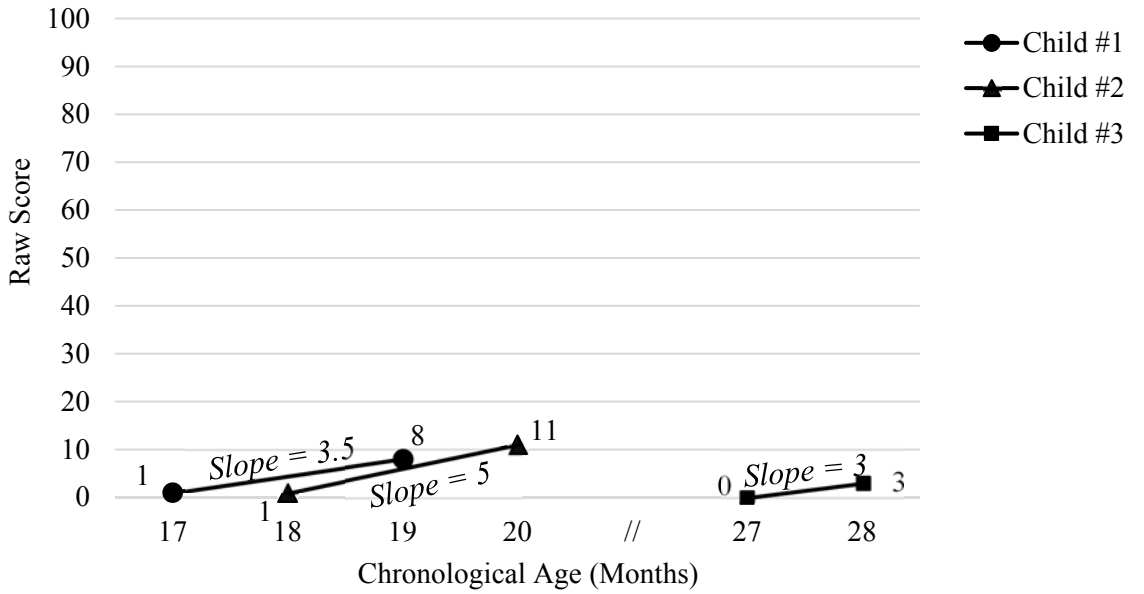

Figure 9. Vocabulary Production Scores & Slopes.

Child 1. As seen in Figure 10, Child 1 exceeded the expected vocabulary production growth when comparing his post data to that of the median child for the adjusted age when he began the study (13 months). This adjusted age represents the closest age in which 50% of the children score the same or higher than the raw score as demonstrated by Child 1 at pre-intervention data collection. The slope for Child 1 (s = 3.5) is greater than the slope for the median child (s = 1). When further analyzed by dividing Child 1's slope by the "median" child's slope, and after accounting for the same amount of time (2 months), Child 1 made 350% of the growth expected of the "median" child at 13 months of age for vocabulary production.

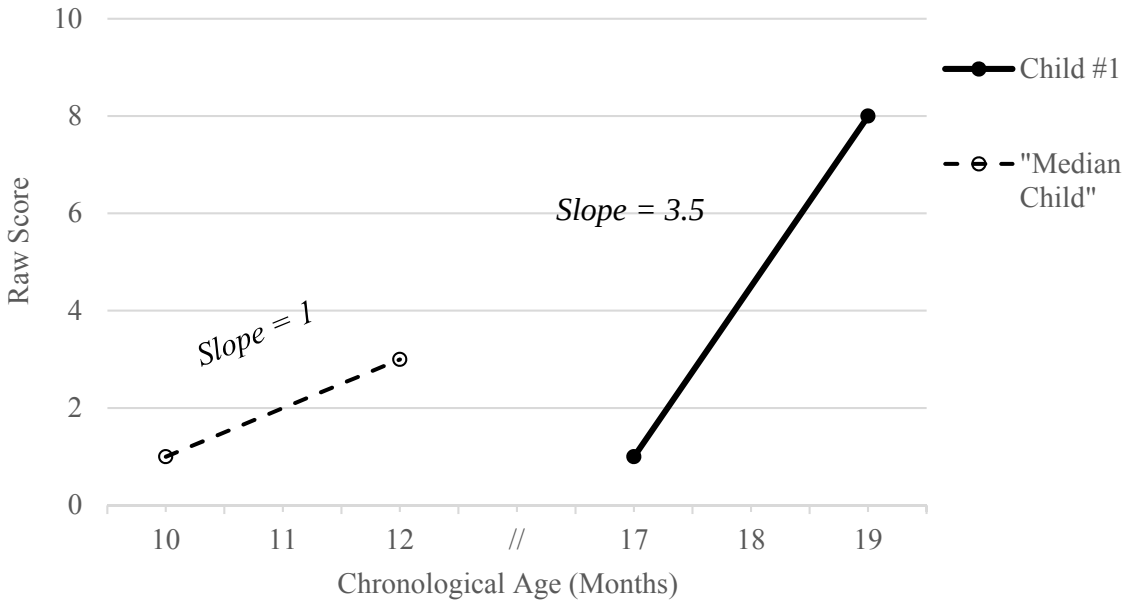

Figure 10. Child 1: Vocabulary Production Growth Compared to "Mean" Child Growth.

Child 2. As seen in Figure 11, Child 2 exceeded the expected vocabulary production growth when comparing his post data to that of the median child for the adjusted age when he began the study (10 months). This adjusted age represents the closest age in which 50% of the children scored the same or higher than the raw score as demonstrated by Child 2 at pre-intervention data collection. The slope for Child 2 (s=5) is larger than the slope for the median child (s=1). When further analyzed by dividing Child 2's slope by the "median" child's slope, and after accounting for the same amount of time (2 months), Child 2 made 500% of the growth expected of the "median" child at 12 months of age for vocabulary production.

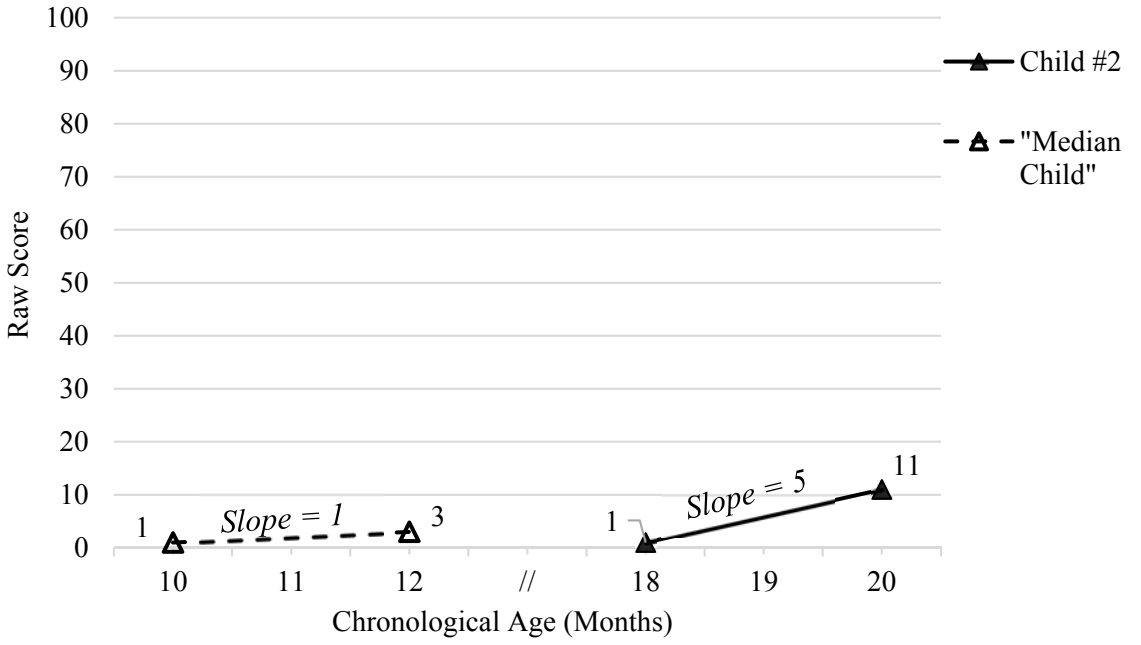

Figure 11. Child 2: Vocabulary Production Growth Compared to "Mean" Child Growth.

Child 3. As seen in Figure 12, Child 3 exceeded the expected vocabulary production growth when comparing his post data to that of the median child for the adjusted age when he began (8 months). This adjusted age represents the closest age in which 50% of the children score the same or higher than the raw score demonstrated by Child 3 at pre-intervention data collection. The slope for Child 3 (s = -3) is larger than the slope for the median child (s = 0).

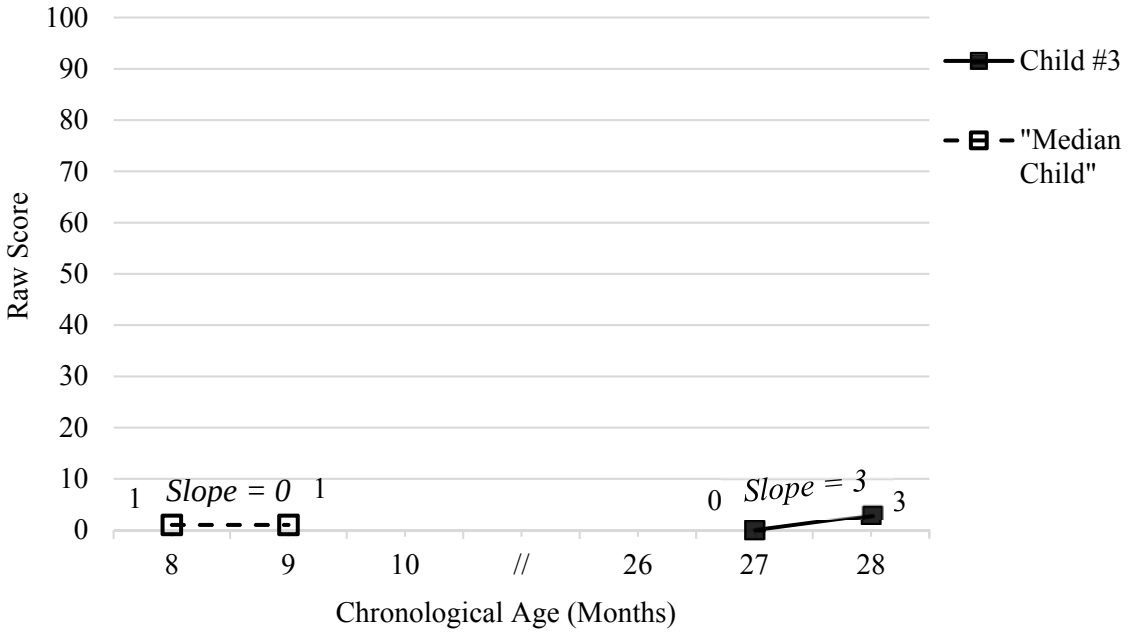

Figure 12. Child 3: Vocabulary Production Growth Compared to "Mean" Child Growth.

When further analyzed by dividing Child 3's slope by the "median" child's slope, and after accounting for the same amount of time (1 month), it appears that Child 3 made 0% of the growth expected of the "median" child at 12 months of age for vocabulary production. However, this 0% growth does not best represent the actual growth made by Child 3 because this percentage was obtained using the equation below. Because the equation included a slope of 0 for the "median" child as the denominator, an error was obtained. However, Child 3 more than tripled the expected vocabulary production that was expected of his comparison median child.

Gestures

Early gestures. Fenson and colleagues (2007) combined both the "Section A: First Communicative Gestures" and "Section B: Games and Routines" from the

"Gestures" subscale of the full version of the CDI: Words and Gestures instrument for norming purposes. Therefore, these two sections of the "gestures" subscale are reported together below. In addition to the normed data and in order to identify changes during the study from pre to post for each child, results for individual items for both subscales are also presented.

Table 10 allows for comparison across children on a numerical perspective. However, the slope of the two lines were compared using the equation below in order to better visualize the actual growth each child made for each subscale when compared to the "median" child for the adjusted pre-intervention age. As seen in Figure 13, Child 1 obtained a slope of 0 between 17 months and 19 months of age, Child 2 obtained a slope of 0.5 between 18 months and 20 months of age, and Child 3 obtained a slope of 2 between 27 months and 28 months of age. These slopes are compared to the respective "median" child's slopes for the same amount of time in Figures 14, 15, and 16.

(Slope)= [(Post Raw Score – Pre Raw Score) / (Post Chronological Age – Pre Chronological Age)]

(%) Growth Expected of Median Child = (Child's Slope / "Median Child" Slope)* 100

Table 10

Individual Early Gestures[1] Normed Data for All Three Children

Child		Child's Age (Mo.)	Early Gestures		Slope	Expected Growth Obtained[2]
			Raw Score	Age Adjustment (50%)[1]		
1	Pre	17 mo.	12	12 mo.		
	Post	19 mo.	12	12 mo.	0	N/A[3]
2	Pre	18 mo.	12	12 mo.		
	Post	20 mo.	13	13 mo.	0.5	50%
3	Pre	27 mo.	11	11 mo.		
	Post	28 mo.	13	13 mo.	2	200%

[1] According to the CDI User's Guide and Technical Manual, results for male children older than 18 months can be indicated by referring to the median or 50th percentile level.
[2] "Expected Growth Obtained (%) refers to the equation below comparing to the growth expected of the median child at that starting age.
[3] Because the equation included a slope of 0 for Child 1 as the numerator, an error was obtained.

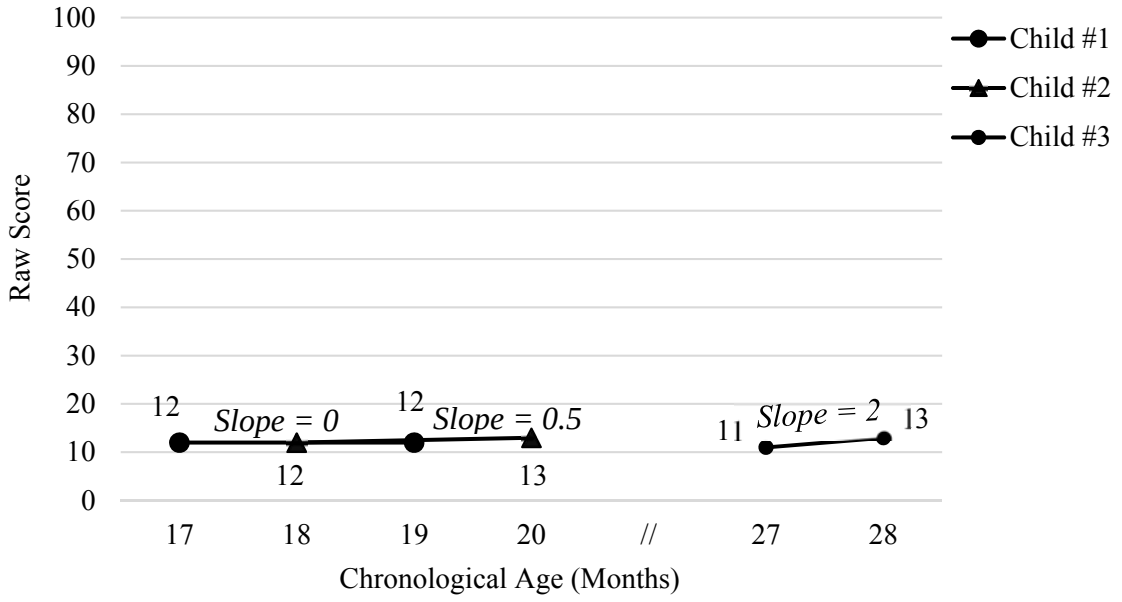

Figure 13. Early Gestures Scores and Slopes.

Child 1. As seen in Figure 14, Child 1 failed to meet the expected "early gestures" growth when comparing his post data to that of the median child for the adjusted age in which he began (14 months). This adjusted age represents the closest age in which 50% of the children score the same or higher than the raw score as Child 1 did at pre-intervention data collection. The slope for Child 1 (s = 0) is less than the slope for the median child (s = 1).

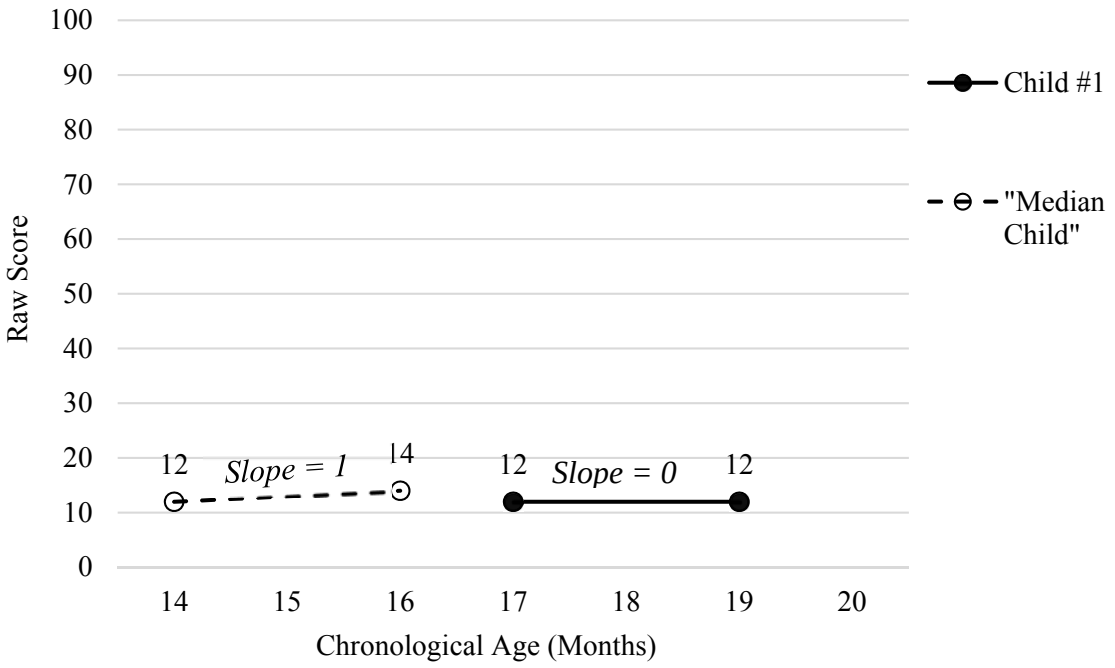

Figure 14. Child 1: Early Gestures Growth Compared to "Mean" Child Growth.

When further analyzed by dividing Child 1's slope by the "median" child's slope, and after accounting for the same amount of time (2 months), it appears that Child 1 made 0% of the growth expected of the "median" child at 14 months of age for "early gestures." However, this 0% growth does not best represent the actual growth made by

Child 1 because this percentage was obtained using the equation below. Because the equation included a slope of 0 for Child 1 as the numerator, an error was obtained. However, Child 1 still failed to meet the expected "early gestures" than when compared to his respective comparison median child.

Child 2. As seen in Figure 15, Child 2 exceeded the expected "early gestures" growth when comparing his post data to that of the median child for the adjusted age in which he began (12 months). This adjusted age represents the closest age in which 50% of the children score the same or higher than the raw score of Child 2 at pre-intervention data collection. The slope for Child 2 (s = 0.5) is equal to slope for the median child (s = 0.5). When further analyzed by dividing Child 2's slope by the "median" child's slope, and after accounting for the same amount of time (2 months), Child 2 made 100% of the growth expected of the "median" child at 12 months of age for "early gestures."

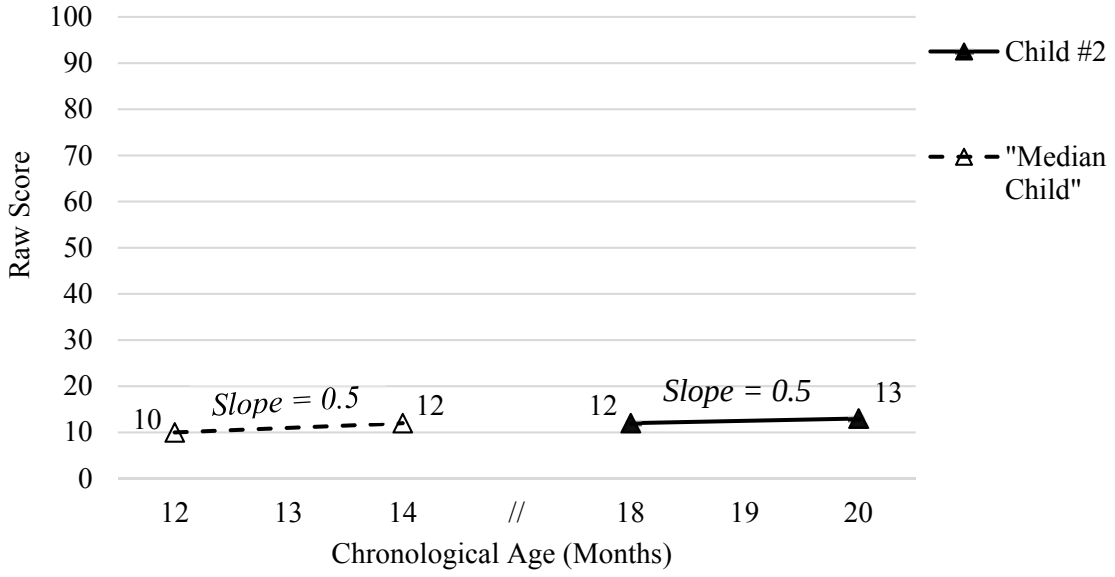

Figure 15. Child 2: Early Gestures Growth Compared to "Mean" Child Growth.

Child 3. As seen in Figure 16, Child 3 did not meet the expected "early gestures" growth when comparing his post data to that of the median child for the adjusted age in which he began (13 months). This adjusted age represents the closest age in which 50% of the children score the same or higher than the raw score of Child 3 at pre-intervention data collection. The slope for Child 3 (s = 2) is smaller than the slope for the median child (s = 1). When further analyzed by dividing Child 3's slope by the "median" child's slope, after accounting for the same amount of time (1 month), Child 3 made 200% of the growth expected of the "median" child at 13 months of age for "early gestures."

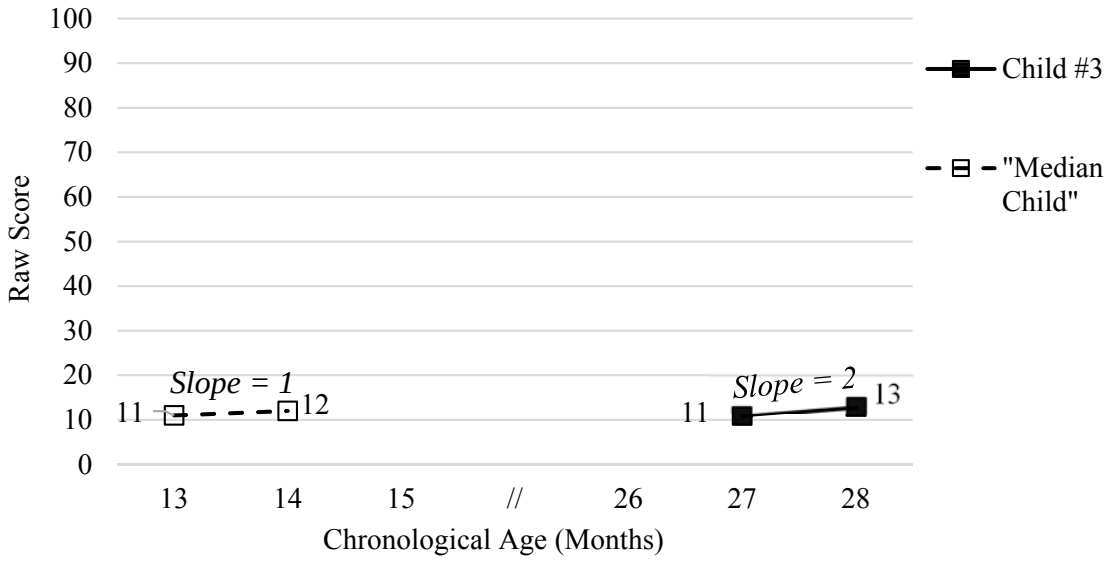

Figure 16. Child 3: Early Gestures Growth Compared to "Mean" Child Growth.

First communicative gestures. As seen in Table 11, individual items on this section of the "Early Gestures" component of the CDI as described above. Table 12 shows that a gradual change occurred among all three children between the time of their pre-intervention and post-intervention language inventory.

Table 11

Individual Child Data on First Communicative Gestures across Pre and Post

Item	Child 1		Child 2		Child 3		All 3 Children	
	Pre	Pre	Pre	Post	Pre	Post	Pre	Post
1. Extends arm to show you something he/she is holding.	Sometimes	Often	Often	Sometimes	Not Yet	Sometimes	Not Yet (1) Sometimes (1) Often (1)	Not Yet (0) Sometimes (2) Often (1)
2. Reaches out and gives you a toy or some object that he/she is holding.	Sometimes	Often	Often	Sometimes	Sometimes	Often	Not Yet (0) Sometimes (2) Often (1)	Not Yet (0) Sometimes (1) Often (2)
3. Points (with arm and index finger extended) at some interesting object or event.	Sometimes	Often	Often	Often	Not Yet	Not Yet	Not Yet (1) Sometimes (1) Often (1)	Not Yet (1) Sometimes (0) Often (2)

Table 11

(Cont.)

Item	Child 1		Child 2		Child 3		All 3 Children	
	Pre	Pre	Pre	Post	Pre	Post	Pre	Post
4. Waves bye-bye on his/her own when someone leaves.	Sometimes	Often	Often	Often	Sometimes	Sometimes	Not Yet (0) Sometimes (2) Often (0)	Not Yet (0) Sometimes (1) Often (2)
5. Extends his/her arm upwards to signal a wish to be picked up.	Often	Often	Often	Often	Often	Often	Not Yet (0) Sometimes (0) Often (3)	Not Yet (0) Sometimes (0) Often (3)
6. Shakes head "no."	Sometimes	Often	Often	Often	Sometimes	Sometimes	Not Yet (0) Sometimes (2) Often (1)	Not Yet (1) Sometimes (1) Often (2)
7. Nods head "yes."	Not Yet	Sometimes	Often	Often	Not Yet	Not Yet	Not Yet (2) Sometimes (1) Often (0)	Not Yet (1) Sometimes (1) Often (1)

Table 11

(Cont.)

Item	Child 1		Child 2		Child 3		All 3 Children	
	Pre	Pre	Pre	Post	Pre	Post	Pre	Post
8. Gestures "hush" by placing finger to lips.	Not Yet	Sometimes	Not Yet	Not Yet	Not Yet	Not Yet	Not Yet (3) Sometimes (0) Often (0)	Not Yet (2) Sometimes (1) Often (0)
9. Requests something by extending arm and opening and closing hand.	Not Yet	Sometimes	Sometimes	Sometimes	Sometimes	Often	Not Yet (1) Sometimes (2) Often (0)	Not Yet (0) Sometimes (2) Often (1)
10. Blows kisses from a distance.	Sometimes	Often	Not Yet	Not Yet	Not Yet	Not Yet	Not Yet (2) Sometimes (1) Often (0)	Not Yet (1) Sometimes (0) Often (2)
11. Smacks lips in a "yum yum" gesture to indicate that something taste good.	Not Yet	Sometimes	Not Yet	Not Yet	Sometimes	Sometimes	Not Yet (2) Sometimes (1) Often (0)	Not Yet (1) Sometimes (2) Often (0)

Table 11

(Cont.)

Item	Child 1		Child 2		Child 3		All 3 Children	
	Pre	Pre	Pre	Post	Pre	Post	Pre	Post
12. Shrugs to indicate "all gone" or "where'd it go."	Not Yet	Sometimes	Not Yet	Not Yet	Not Yet	Not Yet	Not Yet (3) Sometimes (0) Often (0)	Not Yet (2) Sometimes (1) Often (0)

Table 12

First Communicative Gestures Pre and Post Responses for All Three Children

	Child 1		Child 2		Child 3		All 3 Children	
Responses	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Not Yet	42% (*n*=5)	0% (*n*=0)	33% (*n*=4)	17% (*n*=2)	50% (*n*=6)	42% (*n*=5)	42% (*n*=15)	19% (*n*=7)
Sometimes	50% (*n*=6)	42% (*n*=5)	8% (*n*=1)	25% (*n*=3)	42% (*n*=5)	33% (*n*=4)	33% (*n*=12)	33% (*n*=12)
Often	8% (*n*=1)	58% (*n*=7)	58% (*n*=7)	58% (*n*=7)	8% (*n*=1)	25% (*n*=3)	25% (*n*=9)	47% (*n*=17)

Taken together, Tables 11 and 12 reflect the differences in each child's first communicative gestures, as well as across all three children. For example, Child 1's pre-intervention CDI data suggest that he sometimes (50%) and often (8%) used these first communicative gestures. In contrast, this same child's post-intervention data suggest that he sometimes (42%) and often (58%) used these same gestures. Child 2 and 3 both showed similar results. Across all three children, the pre-intervention data suggest that all three children could not yet (42%), sometimes (33%), and often (25%) used these gestures, whereas the post-intervention across the three children indicate that they not yet (19%), sometimes (33%), and often (47%) used the same gestures, indicating an increase in gesture use across children.

Similar to Tables 11 and 12, Figures 17 and 18 visually represent the number of responses each child could either "not yet," "sometimes," and "often" use communicative gestures with a parent or caregiver.

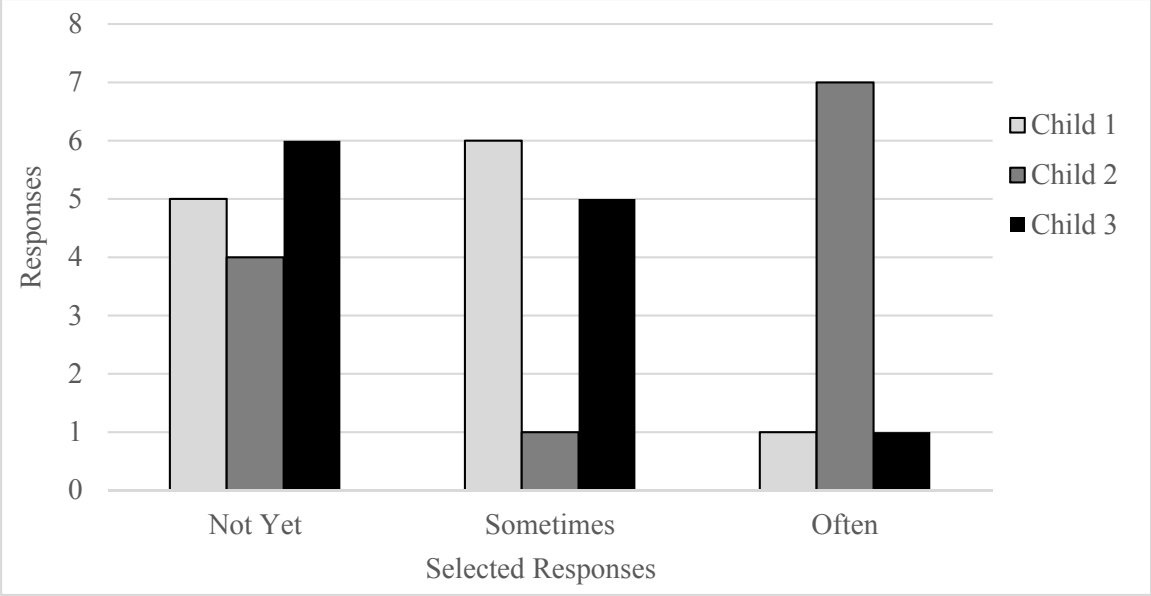

Figure 17. First Communicative Gestures: Pre Intervention Scores for All Three Children.

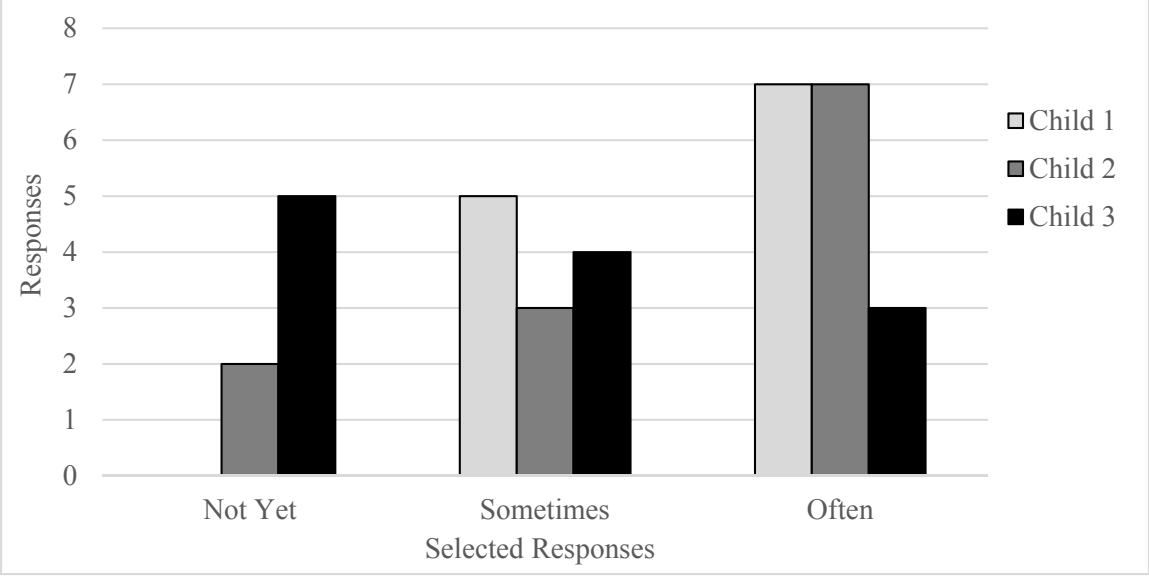

Figure 18. First Communicative Gestures: Post Intervention Scores for All Three Children.

Games and routines. As seen in Table 13, individual items on the second section of the "Early Gestures" component of the CDI are presented. Table 13 shows little change occurred among all three children between the time of their pre-intervention and post-intervention language inventory. Specifically, Child 1 and Child 3 did not gain any new skills in this time period related to this subscale. Child 2 gained one skill, singing, between pre and post-intervention, which typically occurs for children around the age of 12 months (Fenson et al., 2000).

Table 13

Individual Child Data on Games and Routines across Pre and Post

	Child 1		Child 2		Child 3		All 3 Children		Average Age Skill Obtained
Items	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Play peekaboo	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	100%	100%	**<8 mo**
Play patty cake	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	100%	100%	9 mo.
Play "so big"	No	No	No	No	No	No	0%	0%	>18 mo.
Play chasing games	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	100%	100%	10 mo.
Sing	**Yes**	**Yes**	No	**Yes**	**Yes**	**Yes**	67%	100%	12 mo.
Dance	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	100%	100%	10 mo.
Total	5	5	4	5	5	5	14 (78%)	15 (83%)	

All three children's primary caregivers reported that the children had mastered all skills with the exception of one, "playing 'so big,'" which doesn't occur for most

typically developing male children until after 18 months of age (Fenson et al., 2000). All other skills were typically completed by children under the ages of the children in the study, therefore indicating no delays in their "games and routines" gestures.

Pretending to be a parent. Fenson and colleagues (2007) did not norm this subscale individually (see Examiner's Manual), however, the individual items answered by the primary caregivers for this subscale were all normed based on a web-based, cross-linguistic database for lexical data (CLEX) from adaptations of the CDI (Dale & Fenson, 1996; Jorgensen, Dale, Bleses, & Fenson, 2010). For this reason, data are presented in Table 13 as responses to individual items on the scale.

As seen in Table 14, the number of items attained by the three participating children in this subscale were low. However, when compared to the normed data for male children between 8 and 18 months old, all items but one in this subscale occurred after the age of 18 months for typically developing children. The only item that fell within the age range, "Kiss or hug it," item 9, occurring at approximately 12 months for 50% of male children. The resulting data from the current study show that Child 1 did not achieve any of these "pretending to be a parent" gestural skills between 17 and 19 months of age. Child 2 also demonstrated zero of these skills at his pre-intervention age of 18 months, but two months later he gained three skills including "feed with bottle," "feed with spoon," and "kiss or hug it." Child 3 began the study at a slightly older age of 27 months and had already achieved two of these skills: "kiss or hug it" and "talk to it."

Table 14

Pretending to be a Parent Individual Item Analysis

Item	Child 1		Child 2		Child 3		All 3 Children		Average Age Skill Obtained
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
1. Put to bed	No	No	No	No	No	No	0	0	>18 mo.
2. Cover the blanket	No	No	No	No	No	No	0	0	>18 mo.
3. Feed with bottle	No	No	No	**Yes**	No	No	0	1	>18 mo.
4. Feed with spoon	No	No	No	**Yes**	No	No	0	1	>18 mo.
5. Brush/comb its hair	No	No	No	No	No	**Yes**	0	1	>18 mo.
6. Pat or burp it	No	No	No	No	No	No	0	0	>18 mo.
7. Push in stroller/ buggy	No	No	No	No	No	**Yes**	0	1	>18 mo.
8. Rock it	No	No	No	No	No	No	0	0	>18 mo.
9. Kiss or hug it[1]	No	No	No	**Yes**	**Yes**	**Yes**	1	2	12 mo.
10. Try to put shoe or sock or hat on it.	No	No	No	No	No	No	0	0	>18 mo.
11. Wipe its face or hands.	No	No	No	No	No	No	0	0	>18 mo.
12. Talk to it.	No	No	No	No	**Yes**	No	1	0	>18 mo.
Total Items Child Achieved	0	0	0	**3**	**2**	**3**	**2**	**6**	

[1] When compared to the normed data for male children 8-18 months old, this was the only item that fell within the age range, occurring at approximately 12 months for 50% of male children.

However, at his post-intervention age of 28 months, the primary caregiver of Child 3 reported that he had now obtained three of these skills including “brush/comb its

hair," "push in stroller/ buggy," and "kiss or hug it." This post-intervention data suggests that Child 3 either lost the previous skill of being able to "talk to it" when playing or his primary caregiver misreported the achievement of this skill at one or both time periods. Across all three children, a total of two skills were obtained at pre-intervention and six skills at post-intervention, with "kiss or hug it" occurring the most often at post.

Social Validity Results

Prior to collection of baseline data and after the intervention, the three primary caregivers participated in a brief, five item social validity survey. The questions included:

1. I think using signs with my child will help me better understand his/her wants and need
2. I think using signs with my child is a good approach to enhance their communication skills
3. I will carry out the signing intervention as it is taught to me
4. Using signs with my child will be a manageable goal for our daily activities
5. I will refer other parents to use signs with their children.

The primary caregivers were asked to rank the level to which they agreed to each statement on a 5-point Likert scale with 1 being "*strongly disagree*" to 5 being "*strongly agree*" as well as an open area for explanation below each item. Primary caregivers were asked to complete this survey and return to the researcher at the next home visit. Table 15 presents the results of the *Social Validity Survey*. Although all three primary

caregivers completed to the Likert portion of the survey, only one completed the written explanation of each item (see Table 16).

Table 15

Social Validity Survey Results

Item	Primary Caregiver 1		Primary Caregiver 2		Primary Caregiver 3	
	Pre	Post	Pre	Post	Pre	Post
1. I think using signs with my child will help me better understand his/her wants and needs.	4	5	5	5	5	5
2. I think using signs with my child is a good approach to enhance their communication skills.	4	4	5	5	5	5
3. I will carry out the signing intervention as it is taught to me.	4	4	5	5	4	4
4. Using signs with my child will be a manageable goal for our daily activities.	4	4	5	4	4	5
5. I will refer other parents to use signs with their children.	4	4	5	5	4	5
Mean	4	4.2	5	4.8	4.4	4.8

Note: Scores ranged from 1 (strongly disagree) to 5 (strongly agree).

Table 16

Social Validity Survey: Primary Caregiver Written Explanations

Item	Explanation (Pre)[1]	Explanation (Post)[2]
1. I think using signs with my child will help me better understand his/her wants and needs.	"My child has a speech delay, and I think that using signs with him will help me better understand his wants and needs."	"Without [signing] he screams and gets (becomes) frustrated."
2. I think using signs with my child is a good approach to enhance their communication skills.	"Because he sees that there is an alternative to getting his needs met until he begins to form words."	"Because they can use voice or hand sign, they have several ways to communicate."
3. I will carry out the signing intervention as it is taught to me.	"I look forward to carrying out the signing intervention because I feel that it will benefit both me and my child's communication needs. I also want my child to know that there is another way to communicate with me until he begins to talk."	"Anything to understand my child's needs and wants."
4. Using signs with my child will be a manageable goal for our daily activities.	"Once we all get adjusted to these gestures, I feel that yes, using signs with my child will be a manageable goal for our daily activities."	"It is manageable—it has to be added to the daily routine. Having more than 1 child can make it difficult."
5. I will refer other parents to use signs with their children.	"Yes, I will refer other parents to use signs with their children because it is an alternate way to help with children that have developed a speech delay."	"Yes it was and is a successful tool for my child."

[1] Pre explanation only provided by Primary Caregiver 3
[2] Post explanation only provided by Primary Caregiver 2

In addition to the *Social Validity Survey*, the *Primary Caregiver Exit Survey* (Appendix E) also served as a secondary social validity measure. Following the intervention, the primary caregivers of each child was asked to complete the *Primary Caregiver Exit* Survey and to return it to the researcher. This brief survey asked the primary caregivers four open-ended questions:

1. Please describe your experiences during this study. (Describe the process of learning infant signs yourself and for your child.).
2. Were there any benefits of this intervention to your child or family? If so, please explain.
3. Are there any suggestions you would make to the researcher for future interventions on infant signing? (Timing? Dosage? Data collection methods? What worked well? What were the challenges?)
4. Is there anything else you would like to share with me regarding this study that we have not yet discussed?

Table 17 presents the results of the *Primary Caregiver Exit Survey*. Unlike the *Social Validity Survey*, all three primary caregivers responded in length to the questions asked on the *Primary Caregiver Exit Survey.*

In conclusion, this chapter has presented the reliability and treatment integrity data, the resulting data from both the multiple probe design across children as well as the pre- and post-intervention *Child Language Inventory*, and the social validity data resulting from the *Social Validity Survey* and the *Primary Caregiver Exit Survey*. Results are further described in Chapter V, Discussion.

Table 17

Results of Primary Caregiver Exit Survey

Item	Primary Caregiver	Explanation
1. Please describe your experiences during this study. (Describe the process of learning infant signs yourself and for your child.)	1	"I never knew any signs, so it was a learning experience. It was fairly simple and exciting to go from "no response" to spontaneous responses."
	2	"The process was easy to follow. A guide was given if I forgot steps. I could call or text with any concerns."
	3	"My experience during this study was quite challenging in the beginning, only because it wasn't of the normal for us. It seemed to be discouraging to me when I would display these infant signs to my toddler and he would become aggravated only because he didn't understand the concept of what i was trying to convey to him. But, after a couple weeks of repetition, it started to click and this gave me hope!"
2. Were there any benefits of this intervention to your child or family? If so, please explain.	1	"Yes, I feel like communication has improved using the signing—both verbally and with signs."
	2	"It helped us all with sign language. The main benefit was to communicate with understanding."
	3	"Yes, this [intervention] was beneficial because it exposed my child to an alternate method of communication that actually worked! Although, my toddler did not master all three words, he at least understood the concept of how to communicate his wants and needs."

Table 17

(Cont.)

Item	Primary Caregiver	Explanation
3. Are there any suggestions you would make to the researcher for future interventions on infant signing? (Timing? Dosage? Data collection methods? What worked well? What were the challenges?)	1	"Challenge was getting him to sign with the researcher present. Good idea to encourage video clips with a smart phone to show researcher the progress made."
	2	"All was well- research[er] made times fit my schedule."
	3	"I think timing, dosage and data collection methods all worked well. I just think that becoming acclimated was a bit of a challenge for this study. But, once we got use to the routine of signing and [child] began to understand why he was signing, it seemed more natural and beneficial."
4. Is there anything else you would like to share with me regarding this study that we have not yet discussed?	1	No response.
	2	"No"
	3	"No there isn't anything else I would like to share with you regarding this study, other than the fact that I am very grateful for me and my son to have had this opportunity to be a part of this study that served a great purpose in our lives. I am very pleased with the outcome and I would recommend a program of this such to other families who have children that are experiencing some type of speech delays because it is really worth the time and effort!

CHAPTER V

DISCUSSION

Discussion of Results

The purpose of this study was to investigate the potential benefits of a parent-implemented infant signing intervention on the communication skills of young hearing children with diagnosed language delays, as indicated on their Individualized Family Services Plan (IFSP). The following research question guided this investigation: What is the effect of a primary caregiver-implemented infant signing intervention on the frequency of spontaneous and prompted communication attempts, as measured by spoken, signed, or both modalities, for young hearing children with diagnosed language delays when implemented within the child's natural environments and during natural scenarios?

A delayed multiple probe design across three participants was used to determine the impact of the independent variable, the infant signing intervention, on the primary dependent variables, the number of prompted and spontaneous child requests. In addition, a *Child Language Inventory* (Fenson et al., 2007) was also administered during pre- and post-intervention sessions to determine possible additional effects of the infant signing intervention on the children's language skills. This chapter includes: a discussion of the study's implications for the field of early childhood special education, a discussion of the social validity related to the topic, a description of the limitations of the study, as

well as recommendations for future research. Additionally, implications of the results related to Vygotsky's socio-cultural theory (1978) is interwoven throughout.

Implications for the Field

When viewing the results of the current study within Vygotsky's sociocultural lens as discussed within the conceptual model in Chapter 1, the importance of the primary caregiver is evident. Child 1 and 2 showed the most progress when looking at their verbal responses during the intervention study. However, Child 3 made more progress when looking at his prompted responses only. By viewing these children and their primary caregivers through the conceptual model, it is clear how the children's communication skills increased during the study. This change was accomplished by the parents working within their child's zone of proximal development (Vygotsky, 1978) via scaffolding new language skills to them using infant signs. This intervention also occurred within the context of the children's natural home environments, which according to the conceptual model, widens the child's current zone of proximal development. The results pertaining to the intervention also highlight the importance of the individuality within each child's zone of proximal development and how that is perceived within that family setting. For example, Child 1 and 2 had more advanced language skills in their "current skills" than Child 3, but the progress made by Child 3 may have been perceived as the most meaningful, as reported by the primary caregiver.

Signing and language skills. The findings of the current study also add to previous literature by providing additional data that suggests a positive correlation between children's signing and language skills. Specifically, DiCarlo and colleagues (2001)

investigated infant signing with 23 children ages 15 to 36 months of age. The purpose of their study was to put the minds of parents at ease who were concerned that learning sign language would slow their child's language skills. DiCarlo et al.'s data proved the opposite to be true and this study reinforces this research by showing that all three children actually made vocabulary gains rather than setbacks.

The results are also similar to those of a study conducted by Thompson et al. (2007) with regard to maintenance and generalization. The children in the present study continued to show an increase in their usage of signing after the intervention ended, which also carried into settings other than the original ones. However, unlike Thompson et al.'s study, the current study adds to the previous literature by demonstrating positive results after an intervention led by a primary caregiver in the child's home environment. Additionally, the current study demonstrates the potential of a signing intervention with children who have language delays, which is also lacking in previous research.

When results are compared across children, the percentage of non-overlapping data (PND) highlights the differences in the three children and the amount of progress made. Although the percentages may indicate that Child 1 and 2 made the most progress, the written and verbal responses of Primary Caregiver 3 were not captured in this statistic, which adds invaluable data to the study. The results of this study are similar to those of many other previous researchers which suggest benefits of signing to facilitate children's language development (Brereton, 2008; Daniels, 2004; DiCarlo et al., 2001; Gongora & Farkas, 2009; Goodwyn et al., 2000; Harding et al., 2011; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2008, 2009, 2010, 2011b,

2012; Wijkamp et al., 2010). However, unlike the previous studies, results of the current study suggest the use of a home-based, parent-led intervention with young children with language disabilities can be effective.

This study adds to the current literature by providing an intervention within the children's most natural environment, the home setting. According to Part C of the Individuals with Disabilities for Education Improvement Act of 2004 (IDEIA, 2004), all services provided by the state must be provided within the natural environment. Although this study did not fall under these guidelines, this best practice was still followed in order to provide the best practice.

Previous studies have reported similar sign language interventions in the home when implemented by the primary caregiver (Gongora & Farkas, 2009; Goodwyn et al., 2000; Tait et al., 2004; Toth, 2009; Vallotton, 2012), and in community-based primary caregiver signing classes (Howlett et al., 2011; Kirk et al., 2013). However, of these seven studies, only six of them carried out an intervention. Howlett et al. (2011) conducted their study with mothers who were already in ongoing signing classes in order to determine if the signing was creating added stress to their daily lives. They found no correlation between signing and maternal anxiety. Other studies have found the opposite to be true, that adding sign language to the daily routines of a family may actually decrease parent and child frustration (Goodwyn et al., 2000), increase child and parent interactions (Gongora & Farkas, 2009) and maternal responsiveness (Kirk et al., 2013; Vallotton, 2012). The current study adds to this literature base by providing data that suggest similar results. Although parental frustration, anxiety, interactions, and

responsiveness were not measured individually within the current study, the parent written responses after the end of the intervention suggest this to be true. According to the Social Validity Survey and the Primary Caregiver Exit Survey, all parents felt their families had greatly benefitted from this intervention and the support given within the child's natural home environment. These results may help the field of early childhood special education move in a forward direction by providing solid data which suggest the importance of home based interventions.

Additionally, according to one study by Kirk and colleagues (2013), gains were not evident in children of mothers who received "training packets" rather than direct instruction on how to carry out a parent implemented signing intervention. The current study provided clear guidelines, both written and spoken, during a parent sign training session as well as throughout the study as needed. It is evident by the gains made in the current study that a parent training session rather than only handouts or training materials without direct instruction is critical to the success of a parent led intervention. According to McWilliam (2011) and Rogoff (2003, 2014), services provided within the home while also training the parent or primary caregiver provide the best possible outcomes for the children. When this occurs, the modeling allows for the parent to carry out the intervention even when the interventionist is not present. This was the case in the current study.

Target words/signs. During the parent sign training sessions, three target words/signs were chosen. Each primary caregiver in the study was trained on how to elicit and prompt requests from their child based on these three individualized target

words/ signs. These words/ signs were chosen based on each child's current vocabulary, or lack thereof, interests, and level of motivation toward the items (Gast & Ledford, 2010; Harding et al., 2011). Some similarities were found within the words/signs themselves, although the families and children were all independent of one another. All three children's primary caregiver listed either "eat" or "drink" as a motivating item she felt her child would need and want to request on a regular basis. Additionally, all three primary caregivers also choose "book" as a target word/sign and two of the three choose "ball." Only one family chose a different target word/sign for their child, based on his love of his stuffed "Mickey Mouse." However, this target word/sign proved more difficult for the child and family because they reported feeling "silly" making the sign and since it was a two-part sign, it was more difficult for the child to grasp. These findings should be considered when implementing similar future signing interventions in order to create the most beneficial intervention for each individual family.

These results are similar to results found by Ortega and Morgan (2015), whose study suggested signs with increasing phonological parameters, or multiple parts, were more difficult for hearing signers to learn. Additionally, Fusaro and Vallotton (2011) found that children were most likely to produce signs through informal modeling and when referring to relevant objects in their immediate environments. The current study used both informal and formal parent modeling while focusing only on motivating objects in the child's home environment.

Child Language Inventory

Supplemental data from the Child Language Inventory, the Children's Developmental Inventory: Words and Gestures (CDI) were also collected on each child prior to and following the infant signing intervention. The researcher collected this information to determine any potential relationship between the intervention and the chosen subscales on the CDI. Data were collected on subscales that provided information on children's vocabulary comprehension and production, as well as three gestural subscales. No previous research was found to serve as a comparison to the current results since a comparison of single subject data and child language inventories were not found during the literature review process.

Vocabulary skills. As discussed in Chapter 4, when compared to each other, Child 1 and 2 gained vocabulary comprehension skills whereas Child 3 actually appeared to have lost some skills during the intervention phase. Although the true reason this occurred is not known to the researcher, it can be speculated that the primary caregiver completing the inventory may have either over reported during his pre-intervention inventory and/or under reported during his post-intervention inventory. It is also possible that Child 3 actually experienced no real change and the difference in scores is merely a reflection of the measure not being 100% reliable.

The vocabulary production scores produced similar results. All three children made some progress, meaning they each gained new vocabulary words or began approximating more words verbally when communicating.

Gestural skills. When looking at the early gestural skills of all three children, the data suggest that only Child 3 made more than the expected progress, as seen in Chapter 4. Child 3's higher amount of gestural progress may be related to his lower language abilities as well as the less amount of progress seen in his oral language skills, as measured by the vocabulary subscales. However, even though the progress made by Child 3 appears to be large, this represents an increase in two gestural skills, whereas the comparison child would have made only one increase in gestural skills. Nevertheless, the data also suggest that all three children gained skills in making their first communicative gestures (i.e., extending an arm out to show you something he is holding, reaching out and giving you a toy he is holding, and pointing at an interesting object or event).

When comparing the gains made by all three children, these results support previous research suggesting that naturally occurring gestures and signing occur simultaneously (Capirci, Iverson, Montanari, & Volterra, 2002; Fusaro & Vallotton, 2011) and that early gestural use may even predict later sign use (Fenson et al., 2007; Cheek, Cormier, Repp, & Meier, 2001). However, unlike these previous studies, the current study made an attempt to measure both the signing and gestural use before and after the intervention. Therefore, a stronger correlation may be assumed.

Summary

Based on the findings of this study, a functional relationship was found between the independent and dependent variable #1. Specifically, a functional relationship was found between the infant signing intervention and the children's number of prompted requests for the three target words/signs. Because the timeframe for the current

intervention was relatively short, one to two months for each child, the most progress was seen when both the independent/ spontaneous requests were combined with the prompted requests, as seen in Figure 3. All three children demonstrated progress when prompted but only two of the three children demonstrated spontaneous/ independent production of the target words/ signs. The percentage of overlapping data also supported these results.

Additionally, the *Child Language Inventory* provided further supportive data in the areas of vocabulary comprehension and production. The scores on the CDI indicate similar growth for Child 1 and 2 but far less vocabulary growth for Child 3. These data are similar to the single subject data taken by the primary caregivers, suggesting a possible correlation between the infant signing intervention and the production and comprehension of new vocabulary. The gestural data that was collected via the CDI also suggest a possible correlation to the independent variable. All three children gained some level of gestural skills after the intervention when compared to their gestural skills at baseline.

Discussion of Social Validity

Social validation of a study involves the assessment of social acceptability of the intervention program (Kazdin, 1977). According to Wolf (1978) the dependent variable in a single subject design is chosen based on not just a conceptual theory, but primarily because of the perceived importance to the participants, hence it's social validity. Horner and colleagues (2005) suggest that the social validity of single subject design studies is enhanced by (a) choosing dependent variables (e.g., signing intervention) with high social importance, (b) demonstrating fidelity of the independent variable (e.g., effects on

communication attempts) via interventions carried out in meaningful and realistic contexts, and (c) demonstrating that "typical intervention agents" (e.g., parents) report the procedures of such interventions are acceptable, feasible, effective, and likely to be continued after expectations are removed (pp. 172). According to Horner and colleagues (2005), "an effective procedure designed for use by young parents where the procedure fits within the daily family routines would have good social validity . . ." (pp. 172). Data resulting from the *Social Validity Survey* and the *Parent Exit Survey* both indicate social validity was found with the participating parents.

Social Validity

All three parents participating in the study completed the social validity survey prior to the intervention and at the end of the study. These data suggest all three parents perceived the infant signing intervention as important and socially relevant to their family, with slightly more importance seen after the study was completed. Similar results were found on the *Primary Caregiver Exit Survey* once the intervention was complete. These responses also indicated that all three parents felt very positive about the infant signing intervention once the study was complete. These data indicate that the dependent variable chosen, the signing intervention, had high social importance. According to Horner and colleagues (2005), collecting this type of data is one way that social validity may be enhanced within a single subject study.

Limitations

Although this study suggests meaningful effects, there were some limitations. These limitations included issues with recruitment resulting in a delayed baseline for the

third participating family, ethical dilemmas as a result of the methodology chosen, primary caregiver biases when recording data, and procedural fidelity. These potential limitations are discussed.

First, the recruitment difficulties were encountered because of the difficulty of identifying a minimum of three families and children with the specific inclusion criteria set forth by the researcher, while all being individual of one another. The original inclusion criteria for participating children included: (a) 12-36 months of age; (b) currently participating in the North Carolina-Infant Toddler program; (c) has a current Individualized Family Service Plan (IFSP) with at least one language related outcome; (d) currently speaks no more than five words; (e) has a diagnosed speech/language delay; (f) does not have any other diagnosed disabilities; (f) has never been introduced to infant signing or sign language; and (g) is not receiving speech therapy. Although the researcher selected these strict inclusion criteria based on previous research and in order to produce a robust study, these children (and families) were difficult to reach. Because of the lengthy recruitment timeline, the last criterion was eliminated in order to recruit the third family into the study. As a result, the third family entered into the study after the first two families completed their intervention phases, thus resulting in a delayed baseline for Child #3 and creating a threat to the internal validity of the study (Gast, 2010). According to Gast, finding the correct number of tiers for single subject studies is listed as one of the potential limitations of the design. Although this was not ideal, the present study was still able to compare intervention results across a minimum of three participants (Horner et al., 2005).

Second, ethical dilemmas were also encountered. As suggested by Gast (2010), multiple probe studies across participants require a delayed introduction of the independent variable and thus may create adverse experiences for the learners due to boredom, fatigue, or by preventing the family from beginning other useful services for their child such as speech therapy while participating in the study. Because of the difficulty with recruitment, some families were asked to wait for recruitment of other families longer than originally intended. Although this did not cause any potential families from dropping out of the study, this delay in the onset of the intervention could still be considered unethical because a positive effect was anticipated (Gast, 2010).

A third limitation of the study includes the procedural fidelity during the primary caregiver implementation of the independent variable. Although the researcher trained each primary caregiver using the same training protocol, the *Single Subject Observation Protocol,* the amount of parent corrections needed during the researcher's home visits in which the implementation fidelity checks and inter-rater reliability were both collected was of some concern. As suggested by Horner and colleagues, a minimum of 25% of the sessions were observed by the researcher and a score of 100% fidelity was reached for all sessions observed, after corrections were made. However, before corrections were discussed between the researcher and the primary caregiver, the procedural fidelity for each parent's implementation scores fell as low as 71.4 to 75%. Although these numbers are not highly alarming, it is a potential limitation and causes one to suspect lower fidelity when the researcher was not observing the implementation. It should also be noted that although the inter-rater agreement never fell below 100% for the three

families, the parent biases when recording their data when not in the presence of the researcher was still a possibility.

A fourth limitation of the study included the choosing of the target words/signs to be used with each individual child. The targeted signs/words were based on what the primary caregivers felt would be most motivating and interesting for the child to learn (Tait et al., 2004) and would be the most beneficial for the child in terms of getting his/her wants and needs met. In addition to this requirement, the researcher and family selected from the primary caregiver's original list of potential signs/words ones that would not have similar manual representations and ones that would not be to motorically difficult for the child to produce independently. Because of the similarities in the three children, their ages, diagnosis of having a language delay, and the want and need of the primary caregiver to be able to understand the child's requests, some of the words/signs were the same or similar across children. For example, all three children's target words/signs included either "eat" or "drink" and "book," while two of the three children's target words/signs included "ball." However, the remaining target word/sign for Child #3 was "Mickey Mouse." The researcher and primary caregiver decided to keep this sign because it was one of the child's favorite toys and the mother felt as though it would be more motivating than other toys for her child.

A fifth potential limitation for this study is related to the researcher's home visits being scheduled during times in which both the primary caregiver and researcher were available. As a result of having to schedule observations around two people, each child was observed during different parts of their day, therefore resulting in various daily

activities occurring while the researcher was present and collecting data. The researcher attempted to address this potential limitation by observing the child and primary caregiver in the same room of the house and with the same objects as prompts for each child's three target words/signs. Additionally, this potential limitation may have actually served as a strength of the study because of the ability for the researcher to observe the child's response to his target words/signs throughout various times of the day and in various activities and routines that were natural to the family.

Finally, limitations also existed as a result of the instrumentation used. The infant version of the CDI short form was originally normed on 88.7% Caucasian children (Fenson et al., 2007). Additionally, 52.6% of these children were had parents with at least a college diploma (Fenson et al., 2007). These numbers show that the infant version of the CDI was not originally normed on a widely representative sample of American children. The children in the current study were identified as African American (67%) and Bi-racial (33%) and their primary caregivers were self-identified as Caucasian (33%) and African American (67%). The normed sample for the CDI does not match the sample for the current study, therefore serving as a potential limitation.

Suggestions for Future Research

The results of this study indicate that young children with diagnosed language delays are able to learn to communicate via infant signing. Results also indicate that primary caregivers are able to implement such an intervention. According to Horner and colleagues (2005), in order for this method of language intervention to become an "evidence-based practice," at least three more studies must replicate the current

intervention methodology. In order to strengthen the results of this study, further research should be conducted to investigate which signs are most beneficial to children and families, across a more diverse group of participating families. Because of time and sampling restraints, the current study only included male children. Thus, similar research with female children is needed. Additionally, the three participating families were Caucasian, African American, and bi-racial. Families of children with language delays representing additional ethnic/racial backgrounds should be considered for future research as well in order to establish a more diverse literature base.

Future research should also consider examining the effects of a similar infant signing intervention by working parents as compared to those of stay at home parents. Unfortunately, few studies have been conducted in the home when implemented by a primary caregiver (Gongora & Farkas, 2009; Goodwyn et al., 2000; Tait et al., 2004; Toth, 2009; Vallotton, 2012). The current study included working primary caregivers (e.g., mother, grandmother, and foster mother) whose children were in formal child-care settings at least part of the day. This made it difficult to schedule home visits, but also may have influenced the study itself. Children who stay at home with their primary caregiver full time spend more time with that person, which results in more opportunities for modeling and using target words/signs. Future research should take this into consideration and compare the results of children who stay at home full time versus those in child-care settings.

A third recommendation for future research is to investigate parental responsiveness and the effect on child responses in an infant signing intervention.

According to some researchers (Tamis-LeMonda et al., 2001, 2014), parental responsiveness and the amount of subconscious scaffolding provided to a child better meets the needs of the child's current developmental levels and may even predict their early language milestones. This could prove to be especially important for children with diagnosed delays and other disabilities since these children will most likely reach most developmental milestones later than most typically developing children.

A fourth recommendation for future research in this area is to conduct a similar study in the child-care classroom. According to Daniels (1994a, 1996b, 1997), hearing children in a classroom setting learned equally well from teachers with little to no experience using sign language as from teachers with multiple years of experiences using signs. At the time of the current study, a few previous studies have focused on the effects of sign language on children with implemented by a classroom teacher (Brereton, 2008; Daniels, 2004; DiCarlo et al., 2001; Harding et al., 2011; Tincani, 2004; Toth, 2009; Vallotton, 2008, 2009, 2010, 2011b; Wijkamp et al., 2010), however, these were not specific to children with language disabilities only. In order to strengthen the results of the current study, more studies with similar participants across a variety of settings should be conducted.

A final recommendation for future research is to examine the current uses of sign language in homes and child-care settings as well as the reasons underlying why parents and teachers decided to use or not to use sign language with children both with and without disabilities. Based on the current literature available on sign language with hearing children, signing offers benefits in multiple areas of development, as discussed

previously (Barrera et al., 1980; DiCarlo et al., 2001; Goodwyn et al., 2000; Iacono & Duncum, 1995; Kouri, 1988; Nunes, 2008; Powell & Clibbens, 1994; Romski & Ruder, 1984; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2008a, 2008b; Wijkamp et al., 2010; Yoder & Layton, 1988). The current study experienced difficulty during recruitment because of the majority of child-care centers and families that were already using sign language, therefore ruling these children out of the study. Future research should include the families and children who are already using signs in order to examine if these documented benefits serve as potential reasons for using sign language with hearing children or if other explanations exist.

Implications for Practice

The findings of this study have implication for many early childhood advocates including researchers, practitioners, and parents. First, the positive results of this study suggest three conclusions: (a) young hearing children with language disabilities are able to communicate via sign language, (b) home-based interventions work, and (c) parents are able to carry out this type of intervention with their own children.

This study contributes to the field of research of early childhood special education in many ways, as discussed earlier. Similarly, practitioners including teachers, child-care workers, early interventionists, and therapists may also benefit from the results of this study. Practitioners working with young children and their families on a daily basis have known the potential benefits sign language may provide for children without disabilities (Brereton, 2008; DiCarlo et al., 2001; Goodwyn et al., 2000; Perez et al., 2001; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Wijkamp et

al., 2010; Vallotton, 2008, 2010, 2011b, 2012) as well as for children with disabilities (DiCarlo et al., 2001; Wijkamp et al., 2010; Perez et al., 2001; Tait et al., 2004; Thompson et al., 2007; Tincani, 2004; Toth, 2009; Vallotton, 2012). However, the current study adds to the small amount of published literature suggesting the benefit of signing for young hearing children with language delays (Vallotton, 2011c; Wijkamp et al., 2010). The specific methodologies used during the parent sign training could easily be implemented in a classroom or one-on-one setting with a child in a clinic or home-based therapy setting. Practitioners should also note the importance of educating families on this methodology as well as the important benefits such an intervention may provide for their family.

Additionally, practitioners should be encouraged by the correlation found between vocabulary production and a child's increased ability to communicate his wants and needs via manual signs. This study showed such a correlation. All three children made progress in their vocabulary production scores while also showing "effective" or "very effective" increases in their verbal and/or signed requests for their three individualized target words/ signs. Implication of these correlating results could indicate a potential vocabulary spike for children taught signs in various settings.

Finally, parents and children benefit the most from the current findings. The goal of this study was to investigate a potentially beneficial communicative option for this group of children. This was accomplished and the intervention was found to be a beneficial option for these children and families. Specifically, parents and primary caregivers should note their distinct roles of importance when communicating with their

children (e.g., McWilliam, 2011; Vygotsky, 1966, 1978, 2004). The current study was based on a parent-implemented intervention which involved the parents teaching and prompting their children multiple times each day in order to learn how to request motivating items. According to Bradley (1993), a child learns best in his most proximal environment, which is usually with the primary caregiver within the home environment. Ideally, parents will be able to use similar methodologies as the current study implemented in their own homes with their children, who may or may not be experiencing language or other types of delays or disabilities.

Summary

Previous research on the use of sign language suggest potential benefits in many areas of development for typically developing children as well as children with disabilities. However, little research has been conducted on using sign language with young hearing children with language delays. The current study adds to the literature by providing additional data suggesting benefits for this group of children.

The purpose of this study was to investigate the effects of a parent implemented infant signing intervention on young hearing children with language delays. Findings indicate that the three participating children were able to make progress in their verbal and manually signed communication attempts when requesting motivating items. A functional relationship was found between the independent variable (i.e., parent implemented infant signing intervention) and dependent variable #2 (i.e., number of prompted child requests), however no such functional relationship was found between the independent variable and dependent variable #1 (number of spontaneous/ independent

child requests). These results also suggest the usefulness of interventions such as this one for parents, researchers, and practitioners in the field. Replications of this study may lead to an evidence-based practice for the use of infant signing interventions with children with language delays.

REFERENCES

Acredolo, L. P., & Goodwyn, S. W. (1985). Symbolic gesturing in language development: A case study. *Human Development, 28,* 40–49.

Acredolo, L. P., & Goodwyn, S. W. (1988). Symbolic gesturing in normal infants. *Child Development, 59,* 450–466.

Acredolo, L. P., & Goodwyn, S. W. (2000). *The long-term impact of symbolic gesturing during infancy on IQ at age 8.* Paper presented at the meetings of the International Society for Infant Studies, Brighton, UK.

Allen, S. F. (2007). Primary caregivers' perceptions of intervention practices in home visiting programs. *Infants and Young Children, 20,* 266–281.

Autism Society of America (2006). *Defining autism.* Retrieved from http://www.autismsociety.org

Bailes, C. (2001). Integrative ASL-English language arts: Bridging paths to literacy. *Sign Language Studies, 1,* 147–174.

Barnes, S. K. (2010). Sign Language with Babies: What Difference Does It Make? *Dimensions of Early Childhood, 38*(1), 21–30.

Barrera, R. D., Lobato-Barrera, D., & Sulzer-Azaroff, B. (1980). A simultaneous treatment comparison of three expressive language training programs with a mute autistic child. *Journal of Autism and Developmental Disorders, 10,* 21–37.

Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1979). *The emergence of symbols: Cognition and communication in infancy.* New York, NY: Academic Press.

Bates, E., & Dick, F. (2002). Language, gesture, and the developing brain. *Developing Psychobiology, 40,* 293–310.

Baumrind, D. (1967). Child-care practices anteceding three patterns of preschool behavior. *Genetic Psychology Monographs, 75,* 43–88.

Berk, L. E., & Winsler, A. (1995). *Scaffolding children's learning: Vygotsky and early childhood education* (Volume 7 of the NAEYC Research into Practice Series). Washington, DC: National Association for the Education of Young Children.

Billingsley, F. (2004). Commentary on Voeltz and Evans (1983). *Research & Practice for Persons with Severe Disabilities, 29,* 77–79.

Bird, E., Cleave, P., Trudeau, N., Thordardottir, E., Sutton, A., & Thorpe, A. (2005). The language abilities of bilingual children with Down syndrome. *American Journal of Speech-Language Pathology, 14,* 187–199.

Bradley, R. H. (1993). Children's home environment, health, behavior, and intervention efforts: A review using the home inventory as a marker measure. *Child Development, 119,* 439–491.

Bradley, R. H., & Caldwell, B. M. (1976). The relation of infants' home environments to mental test performance at fifty-four months: A follow-up study. *Child Development, 47,* 1172–1174.

Bradley, R. H., & Caldwell, B. M. (1984). The relation of infants' home environments to achievement test performance in first grade: A follow-up study. *Child Development, 55,* 803–809.

Brazelton, T. B. (1999). How to help primary caregivers of young children: The Touchpoints Model. *Journal of Perinatology, 19,* S6–S7.

Brereton, A. (2008). Sign language use and the appreciation of diversity in hearing classrooms. *Early Years: An International Journal of Research and Development, 28,* 311–324.

Briggle, S. J. (2005). Language and literacy development in children who are deaf or hearing impaired. *Kappa Delta Pi Record, 41,* 68–71.

Broaders, S., Cook, S. W., Mitchell, Z., & Goldin-Meadow, S. (2007). Making children gesture brings out implicit knowledge and leads to learning. *Journal of Experimental Psychology: General, 136,* 539–550.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22,* 723–742.

Brooks-Gunn, J., Klebanov, P. K., & Duncan, G. J. (1996). Ethnic differences in children's intelligence test scores: Role of economic deprivation, home environment, and maternal characteristics. *Child Development, 67,* 396–408.

Brooks-Gunn, J., Klebanov, P. K., & Liaw, F. (1995). The learning, physical, and emotional environment of the home in the context of poverty: The infant health and development program. *Children and Youth Services Review, 17,* 251–276.

Butcher, C., & Goldin-Meadow, S. (2000). Gesture and the transition from one- to two-word speech: When hand and mouth come together. In D. McNeill (Ed.), *Language and gesture* (pp. 235–257). New York, NY: Cambridge University Press.

Campbell, R., MacSweeney, M., & Waters, D. (2007). Sign language and the brain: A review. *Journal of Deaf Studies and Deaf Education, 13,* 3–20.

Capirci, O., Contaldo, A., Caselli, M. C., & Volterra, V. (2005). From action to language through gesture: A longitudinal perspective. *Gesture, 5,* 155–177.

Capirci, O., Iverson, J. M., Montanari, S., & Volterra, V. (2002). Gestural, signed and spoken modalities in early language development: The role of linguistic input. *Bilingualism: Language and Cognition, 5*(1), 25–37.

Centers for Disease Control and Prevention. (2009). *Milestone moments: Learn the signs. Act early.* Retrieved from http://www.cdc.gov/ncbddd/actearly/pdf/primary caregivers_pdfs/ milestonemomentseng508.pdf

Cheek, A., Cormier, K., Repp, A., & Meier, R. P. (2001). Prelinguistic gesture predicts mastery and error in the production of early signs. *Language, 77,* 292–323.

Christakis, D. A., Gilkerson, J., Richards, J. A., Zimmerman, F. J., Garrison, M. M., Xu, D., . . . Yapanel, U. (2009). Audible television and decreased adult words, infant vocalizations, and conversational turns. *Archives of Pediatrics & Adolescent Medicine, 163,* 554–558.

Cleveland, H. H., Jacobson, K. C., Lipinski, J. J., & Rowe, D. C. (2000). Genetic and shared environmental contributions to the relationship between the HOME environment and child and adolescent achievement. *Intelligence, 28,* 69–86.

Clibbens, J., Powell, G. G., & Atkinson, E. (2002). Strategies for achieving joint attention when signing to children with Down's syndrome. *International Journal of Language & Communication Disorders, 37,* 309–323.

Communication. (2015). In *Merriam-Webster Dictionary online*. Retrieved from http://www.merriam-webster.com/dictionary/communication

Cook, R. E., Tessier, A., Klein, M. D., & Armbruster, V. B. (2000). Nurturing communication skills. In R. E. Cook, A. Tessier, & M. D. Klein (Eds.), *Adapting early childhood curricula for children in inclusive settings* (5th ed., pp. 290–339). Englewood Cliffs, NJ: Merrill.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Dale, P. S., & Fenson, L. (1996). Lexical development norms for young children. *Behavioral Research Methods, Instruments, & Computers, 28,* 125–127. Retrieved from http://www.cdi-clex.org/sentences/norms/gestures/corpora/1

Daniels, M. (1993). ASL as a factor in acquiring English. *Sign Language Studies, 78,* 23–29.

Daniels, M. (1994a). The effect of sign language on hearing children's language development. *Communication Education, 43,* 291–298.

Daniels, M. (1994b). Words more powerful than sound. *Sign Language Studies, 83,* 1–12.

Daniels, M. (1996a). Bilingual, bimodal education for hearing kindergarten students. *Sign Language Studies, 90,* 25–37.

Daniels, M. (1996b). Seeing language: The effect over time of sign language on vocabulary development in early. *Child Study Journal, 26*(3), 193–208.

Daniels, M. (1997). Teacher enrichment of prekindergarten curriculum with sign language. *Journal of Research in Childhood Education, 12,* 27–33.

Daniels, M. (2001). Sign language advantage. *Sign Language Studies, 2,* 5–19.

Daniels, M. (2004). Happy hands: The effect of ASL on hearing children's literacy. *Reading Research and Instruction, 44*(1), 86–100.

Denney, A. S., & Tewksbury, R. (2013). How to write a literature review. *Journal of Criminal Justice Education, 24*(2), 218–234.

DiCarlo, C. F., Stricklin, S., Banajee, M., & Reid, D. H. (2001). Effects of manual signing on communicative verbalizations by toddlers with and without disabilities in inclusive classrooms. *Journal of the Association for Persons with Severe Handicaps, 26,* 120–126.

Dunst, C. J. (2002). Family-centered practices: Birth through high school. *The Journal of Special Education, 36,* 141–149.

Dunst, C. J., & Trivette, C. M. (1989). An enablement and empowerment perspective of case management. *Topics in Early Childhood Special Education, 8,* 87–102.

Elardo, R., Bradley, R., & Caldwell, B. M. (1975). The relation of infants' home environments to mental test performance from six to thirty-six months: A longitudinal analysis. *Child Development, 46,* 71–76.

Fabes, R., & Martin, C. L. (2003). *Exploring child development* (2nd ed.). New York, NY: Pearson Education, Inc.

Falkman, K. W., & Hjelmquist, E. (2006). Do you see what I mean? Shared reference in non-native, early signing deaf children. *Journal of Deaf Studies and Deaf Education, 11,* 410–420.

Feldman, H. M., Dollaghan, C. A., Campbell, T. F., Kurs-Lasky, M., Janosky, J. E., & Paradise, J. L. (2000). Measurement properties of the MacArthur Communicative Development Inventories at the ages of one and two years. *Child Development, 71,* 310–322.

Fenson, L., Marchman, V. A., Thal, D., Dale, P. S., Reznick, J. S., & Bates, E. (2007). *MacArthur-Bates Communicative Development Inventories: User's guide and technical manual* (2nd ed.). Baltimore, MD: Brookes Publishing.

Fidler, D. J., Philofsky, A., Hepburn, S. L., & Rogers, S. J. (2005). Nonverbal requesting and problem-solving by toddlers with Down syndrome. *American Journal on Mental Retardation, 110,* 312–322.

Fischer, K. W., & Rose, S. P. (1994). Dynamic development of coordination components in brain and behavior: A framework for theory and research. In G. Dawson & K. W. Fischer (Eds.), *Human behavior and the developing brain* (pp. 3–66). New York, NY: Guilford.

Fox, S. E., Levitt, P., & Nelson III, C. (2010). How the timing and quality of early experiences influence the development of brain architecture. *Child Development, 81,* 28–40.

Frank Porter Graham Child Development Institute. (2010). *FPG snapshot: Promoting language and literacy skills in children with Down syndrome, #60.* Chapel Hill, NC: Author.

Fusaro, M., & Vallotton, C. D. (2011). *Giving a nod to social cognition: Developmental constraints on the emergence of conventional gestures and infant signs*. Integrating Gestures. The Interdisciplinary nature of gesture. John Benjamins Publishing Company.

Galvan, J. L. (2009). *Writing literature reviews: A guide for students of the social and behavioral sciences* (4th ed.). Glendale, CA: Pyrczak Publishing.

Garcia, J. (2003). *Sign 2 Me: About our program.* Retrieved from http://www.sign2me.com/about.htm

Gast, D. L. (2010). *Single subject research methodology in behavioral sciences.* New York, NY: Routledge.

Gast, D. L., & Ledford, J. (2010). Multiple baseline and multiple probe designs. In D. L. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pp. 276–328). New York, NY: Routledge.

Gast, D. L., & Spriggs, A. D. (2010). Visual analysis of graphic data. In D. L. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pp. 199–233). New York, NY: Routledge.

Goldstein, H., & Prelock, P. (2009). *Treatment efficacy summary: Child language disorders*. American Speech Language Hearing Association. Retrieved from

http://www.asha.org/uploadedFiles/public/TESChildLanguageDisorders.pdf#search=%22treatment%22

Gongora, X., & Farkas, C. (2009). Infant sign language program effects on synchronic mother-infant interactions. *Infant Behavior and Development, 32,* 216–225.

Goodwyn S. W, & Acredolo L. P. (1993). Symbolic gesture versus word: Is there a modality advantage for onset of symbol use? *Child Development, 64,* 688–701.

Goodwyn, S. W., Acredolo, L. P., & Brown, C. A. (2000). Impact of symbolic gesturing on early language development. *Journal of Nonverbal Behavior, 24,* 81–103.

Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (1998). Role of cognitively stimulating home environment in children's academic intrinsic motivation: A longitudinal study. *Child Development, 69,* 1448–1460.

Haaland, K. Y., Harrington, D. L., & Knight, R. T. (2000). Neural representations of skilled movement. *Brain, 123,* 2306–2313.

Halsband, U., Schmitt, J., Weyers, M., Binkofski, F., Grützner, G., & Freund, H. J. (2001). Recognition and imitation of pantomimed motor acts after unilateral parietal and premotor lesions: A perspective on apraxia. *Neuropsychologia, 39,* 200–216.

Hansuvadha, N. (2009). Compromise in collaborating with families: Perspectives of beginning special education teachers. *Journal of Early Childhood Teacher Education, 30*(4), 346–362.

Harding, C., Lindsay, G., O'Brien, A., Dipper, L., & Wright, J. (2011). Implementing AAC with children with profound and multiple learning disabilities: A study in

rationale underpinning intervention. *Journal of Research in Special Educational Needs, 11,* 120–129.

Hebert, E. B. (2014). Factors affecting parental decision-making regarding interventions for their child with Autism. *Focus on Autism and Other Developmental Disabilities, 29,* 111–124.

Hickok, G., Love-Geffen, T., & Klima, E. S. (2002). Role of the left hemisphere in sign language comprehension. *Brain and Language, 82,* 167–178.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71,* 165–179.

Howlett, N., Kirk, E., & Pine, K. J. (2011). Does 'wanting the best' create more stress? The link between baby sign classes and maternal anxiety. *Infant and Child Development, 20,* 437–445.

Huotilainen, M. (2010). Building blocks of fetal cognition: Emotion and language. *Infant and Child Development, 19,* 94–98.

Huttenlocher, P. R. (1979). Synaptic density in human prefrontal cortex: Developmental changes and effects of aging. *Brain Research, 163,* 195–205.

Huttenlocher, P. R., & Dabholkar, A. S. (1997). Regional differences in synaptogenesis in human cerebral cortex. *Journal of Comparative Neurology, 387,* 167–178.

Iacono, T., & Duncum, J. (1995). Comparison of sign alone and in combination with an electronic communications device in early language intervention: Case study. *Augmentative and Alternative Communication, 11,* 249–259.

Individuals with Disabilities Education Act (IDEA), 34 C.F.R. §300.8(c)(6)

Individuals with Disabilities Education Act (IDEA), (2004). (§303.12)

Individuals with Disabilities Education Act (IDEA), (2004). (§303.26)

Individuals with Disabilities Education Act Regulations (IDEA), C.F.R §305 et seq.

Individuals with Disabilities Education Improvement Act (IDEIA) of 2004, 20 U.S.C. § 1400 et seq. (2004) (reauthorization of the Individuals with Disabilities Education Act of 1990)

Johnson, J. C., Durieux-Smith, A., & Bloom, K. (2005). Teaching gestural signs to infants to advance child development: A review of the evidence. *First Language, 25*(2), 235–251.

Jorgensen, R. N., Dale, P. S., Bleses, D., & Fenson, L. (2010). CLEX: A cross-linguistic lexical norms database. *Journal of Child Language, 37,* 419–428.

Kazdin, A. E. (1977). Assessing the clinical or applied significance of behavior change through social validation. *Behavior Modification, 1,* 427–452.

Kirk, E., Howlett, N., Pine, K. J., & Fletcher, B. C. (2013). To sign or not to sign? The impact of encouraging infants to gesture on infant language and maternal mind-mindedness. *Child Development, 84*(2), 574–590.

Kouri, T. A. (1988). Effects of simultaneous communication in a child-directed treatment approach with preschoolers with severe disabilities. *Augmentative and Alternative Communication, 4,* 222–232.

Lal, R. (2010). Effect of alternative and augmentative communication on language and social behavior of children with autism. *Educational Research and Reviews, 5*(3), 119–125.

Language. (2015). In *Merriam-Webster Dictionary online*. Retrieved from http://www.merriam-webster.com/dictionary/language

Liebeskind, K. G., Piotrowski, J. T., Lapierre, M. A., & Linebarger, D. L. (2014). The home literacy environment: Exploring how media and primary caregiver-child interactions are associated with children's language production. *Journal of Early Childhood Literacy, 14,* 482–509.

MacSweeney, M., Woll, B., Campbell, R., McGuire, P. K., David, A. S., Williams, S. C. R., . . . Bramer, M. J. (2002). Neural systems underlying British Sign Language and audio-visual English processing in native users. *Brain, 125,* 1583–1593.

Maljaars, J., Noens, I., Scholte, E., & van Berckelaer-Onnes, I. (2012). Language in low-functioning children with Autistic Disorder: Differences between receptive and expressive skills and concurrent predictors of language. *Journal of Autism and Developmental Disorders, 42,* 2181–2191.

Maxwell, J. A. (2013). *Qualitative research design: An interactive approach* (3rd ed.). Thousand Oaks, CA: Sage.

McCauley, R., & Fey, M. (2006). *Treatment of language disorders in children*. Baltimore, MD: Brookes Publishing Co.

McWilliam, R. A. (2011). The top 10 mistakes in early intervention in natural environments—and the solutions. *Zero to Three, 31,* 11–16.

McWilliam, R. A., Lang, L., Vandiviere, P., Angell, R., Collins, L., & Underdown, G. (1995). Satisfaction and struggles: Family perceptions of early intervention services. *Journal of Early Intervention, 19*(1), 24–42.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.

Miller, V. A., Schreck, K. A., Mulick, J. A., & Butter, E. (2012). Factors related to primary caregivers' choices of treatments for their children with autism spectrum disorders. *Research in Autism Spectrum Disorders, 6,* 87–95.

Morgenstern, A., Caët, S., Collombel-Leroy, M., Limousin, F., & Blondel, M. (2010). From gesture to sign and from gesture to word: Pointing in deaf and hearing children. *Gesture, 10,* 172–201.

Moyle, J., Stokes, S. F., & Klee, T. (2011). Early language delay and specific language impairment. *Developmental Disabilities Research Reviews, 17,* 160–169.

Namy, L. L., Acredolo, L., & Goodwyn, S. (2000). Verbal labels and gestural routines in parental communication with young children. *Journal of Nonverbal Behavior, 24,* 63–79.

National Dissemination Center for Children with Disabilities. (2011). *NICHCY Disability Fact Sheet 8.* Retrieved from http://nichcy.org/disability/specific/intellectual

National Down Syndrome Society. (2012). *Down Syndrome facts.* Retrieved from http://www.ndss.org/Down-Syndrome/Down-Syndrome-Facts/

National Institute of Neurological Disorders and Strokes. (2013). *National Institute of Neurological Disorders and Strokes Cerebral Palsy information page*. Retrieved from http://www.ninds.nih.gov/disorders/cerebral_palsy/cerebral_palsy.htm

National Institute on Deafness and Other Communication Disorders. (2015). *American Sign Language.* Retrieved from http://www.nidcd.nih.gov/health/hearing/pages/asl.aspx

National Scientific Council on the Developing Child. (2004). *Young children develop in an environment of relationships. Working paper No. 1*. Retrieved from www.developingchild.harvard.edu

National Scientific Council on the Developing Child. (2007). *The timing and quality of early experiences combine to shape brain architecture. Working Paper No. 5*. Retrieved from www.developingchild.harvard.edu

National Scientific Council on the Developing Child. (2012). *The science of neglect: The persistent absence of responsive care disrupts the developing brain. Working Paper 12*. Retrieved from www.developingchild.harvard.edu

Neville, H. J., Bavelier, D., Corina, D., Rauschecker, J., Karni, A., Lalwani, A., . . . Turner, R. (1998). Cerebral organization for language in deaf and hearing subjects: Biological constraints and effects of experience. *Proceedings of the National Academy of Sciences of the United States of America, 95,* 922–929.

Neville, H. J., Mills, D. L., & Lawson, D. S. (1992). Fractionating language: Different neural subsystems with different sensitive periods. *Cerebral Cortex, 2,* 244–258.

Nunes, D. R. P. (2008). AAC interventions for Autism: A research summary. *International Journal of Special Education, 23,* 17–26.

Ortega, G., & Morgan, G. (2015). Phonological development in hearing learners of a sign language: The influence of phonological parameters, sign complexity, and iconicity. *Language Learning, 65,* 660–688.

Owens, R. E. (1996). *Language development: An introduction*. Boston, MA: Allyn & Bacon.

Perez, E. R., Prélaz, A.- C., Morel, B., Rickli, F., Metz-Lutz, M.- N., Braem, P. B., & Deonna, T. (2001). Sign language in childhood epileptic aphasia (Landau-Kleffner syndrome). *Developmental Medicine & Child Neurology, 43,* 739–744.

Petitto, L. A., Holowka, S., Sergio, L. E., Levy, B., & Ostry, D. J. (2004). Baby hands that move to the rhythm of language: Hearing babies acquiring sign languages babble silently on the hands. *Cognition, 93,* 43–73.

Phelps, E. (1999). Brain versus behavioral studies of cognition. In R. Sternberg (Ed.), *The nature of cognition* (pp. 295–322). Cambridge, MA: MIT Press.

Pizer, G., Walters, K., & Meier, R. P. (2007). Bringing up baby with baby signs: Language ideologies and socialization in hearing families. *Sign Language Studies, 7,* 387–430.

Pollak, S. D., Nelson, C. A., Schlaak, M. F., Roeber, B. J., Wewerka, S. S., Wiik, K. L., & Gunnar, M. R. (2010). Neurodevelopmental effects of early deprivation in post-institutionalized children. *Child Development, 81,* 224–236.

Polloway, E. A., Patton, J. R., & Nelson, M. A. (2011). Intellectual and developmental disabilities. In J. M. Kauffman & D. P. Hallahan (Eds.), *Handbook of Special Education* (pp. 175-186). New York, NY: Routledge.

Poveda, D., Pulido, L., Morgade, M., Messina, C., & Hedlova, Z. (2008). Storytelling with sign language interpretation as a multimodal literacy event: Implications for deaf and hearing children. *Language and Education, 22,* 320–342.

Powell, G., & Clibbens, J. (1994). Actions speak louder than words: Signing and speech intelligibility in adults with Down syndrome. *Down syndrome Research and Practice, 2,* 127–129.

Ravitch, S. M., & Riggan, M. (2012). *Rigor & reason: How conceptual frameworks guide research.* Thousand Oaks, CA: Sage.

Rizzolatti, G., & Arbib, M. A. (1998). Language within our grasp. *Trends in Neuroscience, 21,* 188–94.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27,* 169–192.

Rogoff, B. (2003). *The cultural nature of human development.* New York, NY: Oxford University Press.

Rogoff, B. (2014). Learning by observing and pitching in to family and community endeavors: An orientation. *Human Development, 4,* 69–81.

Romski, M. A., & Ruder, K. F. (1984). Effects of speech and sign instruction on oral language learning and generalization of action + object combinations by Down syndrome children. *Journal of Speech and Hearing Disorders, 49,* 293–302.

Rossetti, L. M. (2001). *Communication intervention: Birth to three* (2nd ed.). Albany, NY: Singular/Thomson Learning.

Rowe, M. L., & Goldin-Meadow, S. (2009a). Differences in early gesture explain SES disparities in child vocabulary size at school entry. *Science, 323,* 951–953.

Rowe, M. L., & Goldin-Meadow, S. (2009b). Early gesture selectively predicts later language learning. *Developmental Science, 12,* 182–187.

Rowe, M. L., Ozcaliskan, S., & Goldin-Meadow, S. (2008). Learning words by hand: Gesture's role in predicting vocabulary development. *First Language, 28,* 182–199.

Sameroff, A. (2009). The transactional model. In A. Sameroff (Ed.). *The transactional model of development: How children and contexts shape each other* (pp. 3–21). Washington, DC: American Psychological Association.

Sauer, E., Levine, S. C., & Goldin-Meadow, S. (2010). Early gesture predicts language delay in children with pre- or perinatal brain lesions. *Child Development, 81,* 528–539.

Scruggs, T. E., & Mastropieri, M. A. (1998). Summarizing single subject research: Issues and applications. *Behavior Modification, 22,* 221–242.

Sigafoos, J., Butterfield, N., & Arthur-Kelly, M. (2006). Key concepts. *Enhancing everyday communication for children with disabilities* (pp. 1–22). Baltimore, MD: Brookes Publishing, Inc.

Soderfeldt, B., Ingvar, M., Ronnberg, J., Eriksson, L., Serrander, M., & Stone-Elander, S. (1997). Signed and spoken language perception studied by positron emission tomography. *Neurology, 49,* 82–87.

Tait, M. E., Nikolopoulos, T. P., Wells, P., & White, A. (2007). The use and reliability of Tait video analysis in assessing prelinguistic language skills in profound deaf and normally hearing children under 12 months of age. *International Journal of Pediatric Otorhinolaryngology, 71,* 1377–1382.

Tait, K., Sigafoos, J., Woodyatts, G., O'Reilly, M., & Lancioni, G. (2004). Evaluating primary caregiver use of functional communication training to replace and enhance prelinguistic behaviours in six children with developmental and physical disabilities. *Disability and Rehabilitation: An International, Multidisciplinary Journal, 26,* 1241–1254.

Takei, W. (2001). How do deaf infants attain first signs? *Developmental Science, 4,* 71–78.

Tamis-LeMonda, C. S., Bornstein, M. H., & Baumwell, L. (2001). Maternal responsiveness and children's achievement of language milestones. *Child Development, 72,* 748–767.

Tamis-LeMonda, C. S., Kuchirko, Y., & Song, L. (2014). Why is infant language learning facilitated by parental responsiveness? *Current Directions in Psychological Science, 23,* 121–126.

Thal, D., & Tobias, S. (1992). Communicative gestures in children with delayed onset of oral expressive vocabulary. *Journal of Speech and Hearing Research, 35,* 1281–1289

The National Institute on Deafness and Other Communication Disorders. (2015). *American Sign Language.* Retrieved from http://www.nidcd.nih.gov/health/hearing/pages/asl.aspx

Thompson, R. A., & Nelson, C. A. (2001). Developmental science and the media: Early brain development. *American Psychologist, 56,* 5–15.

Thompson, R. H., Cotnoir-Bichelman, N. M., McKerchar, P. M., Tate, T. L., & Dancho, K. A. (2007). Enhancing early communication through infant sign training. *Journal of Applied Behavior Analysis, 40,* 15–23.

Tincani, M. (2004). Comparing the Picture Exchange Communication System and Sign Language Training for Children with Autism. *Focus on Autism and Other Developmental Disabilities, 19,* 152–163.

Toth, A. (2009). Bridge of signs: Can sign language empower non-deaf children to triumph over their communication disabilities? *American Annals of the Deaf, 154,* 85–95.

Turner III, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. *The Qualitative Report, 15,* 754–760.

Tzanakaki, P., Grindle, C., Hastings, R. P., Hughes, J. C., Kovshoff, H., & Remington, B. (2012). How and why do primary caregivers choose early intensive behavioral

intervention for their young child with Autism? *Education and Training in Autism and Developmental Disabilities, 47,* 58–71.

U.S. Department of Education, National Center for Education Statistics. (2007). *National Household Education Surveys Program—School Readiness and Primary caregiver and Family Involvement in Education Survey* [Computer file]. Washington, DC: Produced by the Institute of Education Sciences. Retrieved from http://nces.ed.gov/nhes/questionnaires.asp

Vallotton, C. D. (2008a). Infants take self-regulation into their own hands. *Zero to Three, 29*, 30-34.

Vallotton, C. D. (2008b). Signs of emotion: What can preverbal children "say" about internal states? *Infant Mental Health Journal, 29,* 234–258.

Vallotton, C. D. (2009). Do infants influence their quality of care? Infants communicative gestures predict caregivers' responsiveness. *Infant Behavior & Development, 32,* 351–365.

Vallotton, C. D. (2010). Support or competition? Dynamic development of the relationship between manual pointing and symbolic gestures from 6 to 18 months of age. *Gesture, 10,* 150–171.

Vallotton, C. D. (2011a). Babies open our minds to their minds: How "listening" to infant signs complements and extends our knowledge of infants and their development. *Infant Mental Health Journal, 32*(1), 115–133.

Vallotton, C. D. (2011b). Sentences and conversations before speech? Gestures of prelinguistic children reveal cognitive and social skills that do not wait for words.

In G. Stam & M. Ishino (Eds.), *Integrating gestures: The interdisciplinary nature of gesture* (pp. 105–120). Amsterdam, The Netherlands: John Benjamins Publishing Co.

Vallotton, C. D. (2011c). *Signing with babies and children: A summary of research findings for primary caregivers and professionals.* Commissioned by Two Little Hands Productions.

Vallotton, C. D. (2012). Infant signs as intervention? Promoting symbolic gestures for prelinguistic children in low-income families supports responsive primary caregiver-child relationships. *Early Childhood Research Quarterly, 27,* 401–415.

Vallotton, C. D., & Ayoub, C. C. (2010). Symbols build communication and thought: The role of gestures and words in the development of engagement skills and social-emotional concepts during toddlerhood. *Social Development, 19,* 601–626.

Valsiner, J. (2006). The semiotic construction of solitude: Processes of internalization and externalization. *Sign Systems Studies, 34,* 9–35.

Vygotsky, L. S. (1966). Play and its role in the mental development of the child. *Soviet Psychology, 5*(3), 6–18.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press. (Original manuscripts [ca. 1930-1934])

Vygotsky, L. S. (1986). *Thought and language.* Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (2004). *Imagination and creativity in childhood* (M. E. Sharpe, Trans.). Moscow: M. E. Sharpe, Inc. (Original work published 1967)

Wang, Y. (2009). Impact of Lev Vygotsky on special education [L'influence de Vygotsky sur l'education speciale]. *Canadian Social Science, 5,* 100–103.

Wang, M., & Brown, R. (2009). Family quality of life: A framework for policy and social service provisions to support families of children with disabilities. *Journal of Family Social Work, 12,* 144–167.

Warren, S. F., & Yoder, P. J. (1998). Facilitating the transition from preintentional to intentional communication. In A. Wetherby, S. E. Warren, & J. Reichle (Eds.), Transitions in prelinguistic communication (Vol. 7, pp. 365–384). Baltimore, MD: Brookes.

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *Management Information Systems [MIS] Quarterly, 26,* xiii–xxiii.

Weiss, P. H., Dohle, C., Binkofski, F., Schnitzler, A., Freund, H. J., & Hefter, H. (2001). Motor impairment in patients with parietal lesions: Disturbances of meaningless arm movement sequences. *Neuropsychologia, 39*(4), 397–405.

Werner, L., & Kaplan, B. (1963). *Symbol formation: An organismic approach to language and expression of thought.* New York, NY: Wiley.

Wertsch, J. V. (1985). *Vygotsky and the social formation of mind.* Cambridge, MA: Harvard University Press.

Wertsch, J. V., del Rio, P., & Alvarez, A. (Eds.). (1995). *Sociocultural studies of the mind.* New York, NY: Cambridge University Press.

Wertsch, J. V., & Tulviste, P. (1992). L. S. Vygotsky and contemporary developmental psychology. *Developmental Psychology, 28,* 548–557.

Wijkamp, I., Gerritsen, B., Bonder, F., Haisma, H., & van der Schans, C. (2010). Sign-supported Dutch in children with severe speech and language impairments: A multiple case study. *Child Language Teaching and Therapy, 26,* 273–286.

Wilcox, M. J., & Woods, J. (2011). Participation as a basis for developing early intervention outcomes. *Language, Speech, and Hearing Services in Schools, 42,* 365–378.

Wolery, M., & Lane, K. L. (2010). Writing tasks: Literature reviews, research proposals, and final reports. In D. L. Gast & J. R. Ledford (Eds.), *Single subject research methodology in behavioral sciences* (pp. 57–90). New York, NY: Routledge.

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis, 11,* 203–214.

Wood, D., Bruner, J. S., & Ross, G. (1976). The roll of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, 17,* 89–100.

World Federation of the Deaf. (Retrieved March 5, 2015). Retrieved from http://wfdeaf.org/our-work/focus-areas/sign-language

World Health Organization. (1993). *ICD-10 Classification of Mental and Behavioral Disorders: Clinical Description and Diagnostic Guidelines.* Geneva, Switzerland: Author.

Wulbert, M., Inglis, S., Kriegsmann, E., & Mills, B. (1975). Language delay and associated mother/child interactions. *Developmental Psychology, 11,* 61–70.

Yoder, P. J., & Layton, T. L. (1988). Speech following sign language training in autistic children with minimal verbal language. *Journal of Autism and Developmental Disorders, 18,* 217–229.

Yoder, P. J., McCathren, R. B., Warren, S. F., & Watson, A. L. (2001). Important distinctions in measuring maternal responses to communication in prelinguistic children with disabilities. *Communication Disorders Quarterly, 22,* 135–147.

APPENDIX A

SINGLE SUBJECT OBSERVATION PROTOCOL

Family: _____ Date: _____
Directions:
The parent will record (5 trials/word/day) according to the key below if the child responded to his/her prompting with a sign only, a spoken response (word) only, both the sign and the word, or did not respond with either of the three other options.

> **SPONTANEOUS/ UNPROMPTED RESPONSES:** The parent will record similarly to the prompted responses but the number of spontaneous responses may differ daily. The parent will record only the child's spontaneous attempts or correct requests using spoken or signed language.

WORD/SIGN: _____

Prompted or Spontaneous Responses	Trial #	Social Routine	Child Response					Explanation
			SIGN	WORD	BOTH	APPROX.	N/R	
Prompted								

Prompted or Spontaneous Responses	Trial #	Social Routine	Child Response					Explanation
			SIGN	WORD	BOTH	APPROX.	N/R	
Spontaneous								

Single Subject Observation Protocol

Family: _____ **Date:** _____

Directions:

The parent will record (5 trials/word/day) according to the key below if the child responded to his/her prompting with a sign only, a spoken response (word) only, both the sign and the word, or did not respond with either of the three other options.

An example is shown in red below.

SPONTANEOUS/ UNPROMPTED RESPONSES: The parent will record similarly to the prompted responses but the number of spontaneous responses may differ daily. The parent will record only the child's spontaneous attempts or correct requests using spoken or signed language. **An example is shown in green below.**

WORD/SIGN: **"Juice"**

Prompted or Spontaneous Responses	Trial #	Social Routine	Child Response					Explanation
			SIGN	WORD	BOTH	APPROX.	N/R	
Prompted Responses	1	Breakfast					*	E.g., "Child didn't respond when I prompted her or when I helped her make the sign. She just cried."
	2	Snack			*	*		E.g., "Child attempted to make sign and babbled after I prompted her"
	3	Lunch		*		*		E.g., "Child attempted to say word after I prompted her."
Spontaneous	4	Lunch			*	*		E.g., "I put the juice on the table and after waiting a

Prompted or Spontaneous Responses	Trial #	Social Routine	Child Response					Explanation
			SIGN	WORD	BOTH	APPROX.	N/R	
Responses								few seconds, she said "ju" and made an approximated sign for 'juice'."
	5	In Bed	*			*		E.g., "Child attempted to sign 'juice' while lying in bed during his bedtime routine without prompting."

APPENDIX B

CHILD LANGUAGE INVENTORY

MacArthur-Bates Short Form Vocabulary Checklist: Level I

Please circle who filled out this form:
mother father
other (specify relation to child) _____
_____

Child's Name _____ Sex _____

Birthdate _____ Today's Date _____

VOCABULARY CHECKLIST

For words your child understands but does not yet say, mark the first column (understands). For words that your child not only understands but also says, mark the second column (understands and says). If your child uses a different pronunciation of a word, mark it anyway.

	Understands	Understands and says		Understands	Understands and says		Understands	Understands and says
choo choo	O	O	chair	O	O	wait	O	O
meow	O	O	couch	O	O	break	O	O
ouch	O	O	kitchen	O	O	feed	O	O
uh oh	O	O	table	O	O	finish	O	O
bird	O	O	television	O	O	help	O	O
dog	O	O	blanket	O	O	jump	O	O
duck	O	O	bottle	O	O	kick	O	O
kitty	O	O	cup	O	O	kiss	O	O
lion	O	O	dish	O	O	push	O	O
mouse	O	O	lamp	O	O	sing	O	O
car	O	O	radio	O	O	smile	O	O
stroller	O	O	spoon	O	O	night	O	O
ball	O	O	flower	O	O	today	O	O
book	O	O	home	O	O	all gone	O	O
doll	O	O	moon	O	O	big	O	O
bread	O	O	outside	O	O	broken	O	O
candy	O	O	plant	O	O	dark	O	O
cereal	O	O	rain	O	O	fast	O	O
cookie	O	O	rock	O	O	hurt	O	O
juice	O	O	water	O	O	pretty	O	O
toast	O	O	babysitter	O	O	soft	O	O
hat	O	O	girl	O	O	I	O	O
pants	O	O	grandma	O	O	me	O	O
shoe	O	O	mommy	O	O	how	O	O
sock	O	O	bath	O	O	who	O	O
eye	O	O	don't	O	O	away	O	O
head	O	O	hi	O	O	out	O	O
leg	O	O	night night	O	O	other	O	O
nose	O	O	patty cake	O	O	some	O	O
tooth	O	O	please	O	O		O	O

FIRST COMMUNICATIVE GESTURES

When infants are first learning to communicate, they often use gestures to make their wishes known. For each item below, mark the line that describes your child's actions right now.

		Not Yet	Sometimes	Often
1.	Extends arm to show you something he/she is holding.	O	O	O
2.	Reaches out and gives you a toy or some object that he/she is holding.	O	O	O
3.	Points (with arm and index finger extended) at some interesting object or event.	O	O	O
4.	Waves bye-bye on his/her own when someone leaves.	O	O	O
5.	Extends his/her arm upwards to signal a wish to be picked up.	O	O	O
6.	Shakes head "no".	O	O	O
7.	Nods head "yes".	O	O	O
8.	Gestures "hush" by placing finger to lips.	O	O	O
9.	Requests something by extending arm and opening and closing hand.	O	O	O
10.	Blows kisses from a distance.	O	O	O
11.	Smacks lips in a "yum yum" gesture to indicate that something taste good.	O	O	O
12.	Shrugs to indicate "all gone" or "where'd it go".	O	O	O

GAMES AND ROUTINES

Does your child do any of the following?

		Yes	No
1.	Play peekaboo.	O	O
2.	Play patty cake.	O	O
3.	Play "so big".	O	O
4.	Play chasing games.	O	O
5.	Sing.	O	O
6.	Dance.	O	O

PRETENDING TO BE A PARENT

Here are some things that young children sometimes do with stuffed animals or dolls. Please mark the actions that you have seen your child do?

		Yes	No
1.	Put to bed.	O	O
2.	Cover the blanket.	O	O
3.	Feed with bottle.	O	O
4.	Feed with spoon.	O	O
5.	Brush/comb its hair.	O	O
6.	Pat or burp it.	O	O
7.	Push in stroller/ buggy.	O	O
8.	Rock it.	O	O
9.	Kiss or hug it.	O	O
10.	Try to put shoe or sock or hat on it.	O	O
11.	Wipe its face or hands.	O	O
12.	Talk to it.	O	O
13.	Try to put diaper on it.	O	O

APPENDIX C

DEMOGRAPHIC SURVEY

Demographic Survey

Date completed: _____

CHILD'S INFORMATION:

Child's full name: _____

Address: _____

City: _____ **State:** _____ **ZIP:** _____

Phone Number: (_____)_____

Child's Birthdate: ___/___/___ **Age:** _____ **Gender**: □Boy □Girl

Child's Race (Check all that apply):
□ American Indian or Alaska Native
□ Asian
□ Black or African American
□ Native Hawaiian or Other Pacific Islander
□ White
□ Hispanic Origin _____
□ Other_____ (specify country of origin)

PRIMARY CAREGIVER'S INFORMATION:

Primary caregiver's name

_____

Last *First* *Middle Initial*

Relationship to child: □ Mother □ Father □ Other: _____

Highest grade completed _____ **Birth date** ___/___/___

Languages spoken: _____

Marital status: _____

Race: (Check all that apply):

□ American Indian or Alaska Native
□ Asian
□ Black or African American
□ Native Hawaiian or Other Pacific Islander
□ White
□ Hispanic Origin _____
□ Other_____(specify country of origin)

Please check any current health conditions:
□ Depression
□ Anxiety
□ Schizophrenia
□ Other: _____

SECONDARY CAREGIVER'S INFORMATION:

Secondary caregiver's name _____
Last *First* *Middle Initial*

Relationship to child: □ Mother □ Father □ Other: _____

Highest grade completed _____ Birth date ___/___/___

Languages spoken: _____

Marital status: _____

Race: (Check all that apply):
□ American Indian or Alaska Native
□ Asian
□ Black or African American
□ Native Hawaiian or Other Pacific Islander
□ White
□ Hispanic Origin _____
□ Other_____(specify country of origin)

Please check any current health conditions:
□ Depression
□ Anxiety
□ Schizophrenia
□ Other: _____

HOUSEHOLD INFORMATION:

Number of adults in household *(18 years and older)*: _____

Number of children in household *(under 18 years old)*: _____

Adults living with child: □ Mother □ Father □ Grandparent
□ Other _____

Annual family income level:

□ Below $10,000	□ $10,000-$20,000	□ $20,000-$30,000
□ $30,000-$40,000	□ $40,000-$50,000	□ $50,000-$60,000
□ $60,000-$70,000	□ $70,000-$80,000	□ Above $80,000

Do you have internet access at home? □ Yes □ No

APPENDIX D

SOCIAL VALIDITY SURVEY

Date _____

Your Name _____ _____ _____

Last *First* *Middle Initial*

Please answer the following questions on the scale below.

Question	**1** **Strongly Disagree**	**2** **Disagree**	**3** **Not Sure/ N/A**	**4** **Agree**	**5** **Strongly Agree**
I think using signs with my child will help me better understand his/her wants and needs. Explain:	□	□	□	□	□
I think using signs with my child is a good approach to enhance their communication skills. Explain:	□	□	□	□	□
I will carry out the signing intervention as it is taught to me.	□	□	□	□	□

Explain:

Using signs with my child will be a manageable goal for our daily activities.	□	□	□	□	□

Explain:

I will refer other parents to use signs with their children.	□	□	□	□	□

Explain:

_____ _____

Signature of parent completing form *Date*

APPENDIX E

PRIMARY CAREGIVER EXIT SURVEY

Parent Exit Interview

Directions: Research to conduct interview during last visit to family's home, after intervention data has been collected.

1. Please describe your experiences during this study.
    - *Describe the process of learning infant signs yourself and for your child.*

2. Were there any benefits of this intervention to your child or family? If so, please explain.

3. Are there any suggestions you would make to the researcher for future interventions on infant signing?
    - *Timing? Dosage? Data collection methods?*
    - *What worked well? What were the challenges?*

4. Is there anything else you would like to share with me regarding this study that we have not yet discussed?

APPENDIX F

RECRUITMENT FLIERS

UNCG School of Education

Infant-Toddler Signing Study

IDEAs that Work Office of Special Education Programs

Signing has been shown to support children's development for children with and without disabilities. Help us better understand the potential benefits of using infant signing as well as potentially gaining insight into your child's needs and wants!

Purpose of this Study:

- To investigate the potential benefits of using signs on the communication skills of young hearing children with diagnosed language delays

Who Can Participate?

- Families of children age between 12-36 months old
- Families who speak English as their primary home language
- Children participating in the NC Infant-Toddler Program with a current written IFSP
- Children with diagnosed language delays as the only diagnosis
- Children who are currently speaking *5* or fewer words.

Requirements for Families:

- Up to 30 hours of participation across 8-10 weeks (Assessments and Paperwork, Parent data collection, Researcher home visits)
- Commitment not to seek information about infant signing or gestures outside of the study

When & Where?

- Initial interview will occur over the phone
- All other sessions will occur in the family's home
- Across 8-10 weeks during Summer of 2015

Potential Benefits of the study:

- Potential communication benefits for your child and family
- Enhance the understanding on the potential benefits of using infant signing with young preverbal hearing children with diagnosed language delays.
- Produce research data for other parents and teachers who may benefit from an infant signing intervention.

Compensation:

- Gift cards totaling $150 to popular merchant

Contact Info:

Fain Barker, M.S.
Principal Investigator/ Doctoral Student, UNCG
336.409.3745, afblackb@uncg.edu

Approved IRB
7/7/15

APPENDIX G

CONSENT TO CONTACT

UNCG School of Education

Infant- Toddler Signing Study

IDEAs that Work
Office of Special Education Programs

Project Title: Using Signs to Enhance Communication for Young Preverbal Hearing Children with Diagnosed Language Delays

Principle Investigator: Fain Barker, M.S.

By signing below, I agree that I have read the recruitment flier for the above named study and that I am interested in discussed the possibility of participating in this study. I understand that by signing this form, I am giving the principle investigator, Fain Barker, the right to contact me directly to discuss the study details. I also understand that no other agency or individuals are involved in this study other than the ones listed on this form. My child's Early Intervention services will neither be enhanced or decreased because of my participation in this study. Once I am contacted by the principle investigator, Fain Barker, I understand that I may change my mind at any time if decide not to participate in the study.

Please complete the following information and return to your provider (e.g., Service Coordinator, Therapist, Child Care Worker):

My Name: _____ **My Age:** _____

My Child's Name: _____ **Child's Age:** _____

My Relationship to Child: _____

Best Phone Number to Reach Me: _____

Best Times to Call: _____

Email Address: _____

_____ _____

Parent Signature **Date**

****

I may also contact the principle investigator at any time at the email or phone number below:

Fain Barker, M.S.
Principal Investigator/ Doctoral Student, UNCG
336.409.3745, afblackb@uncg.edu

Approved IRB
3/3/15

APPENDIX H

PHONE RECRUITMENT INTERVIEW

QUESTIONS ABOUT PRIMARY CAREGIVER:	Eligible Answers	Non-Eligible Answers
1. Do you speak English?	Yes	No
2. Do you spend at least five hours a day with your child?	Yes	No
3. Do you live in the same home as your child?	Yes	No
4. Are you at least 18 years old?	Yes	No
QUESTIONS ABOUT CHILD:		
1. Is your child between 12-36 months of age?	Yes	No
2. Is your child in the North Carolina-Infant Toddler Program?	Yes	No
3. Does your child have a written Individualized Family Service Plan (IFSP) with at least one language related outcome?	Yes	No
4. Does your child have a diagnosed speech/language delay?	Yes	No
5. Does your child currently say more than five words?	No	Yes
6. Does your child have any other diagnosed disabilities?	No	Yes
7. Has your child has ever been introduced to infant signing or sign language?	No	Yes
8. Is your child receiving speech therapy?	No	Yes

APPENDIX I

CONSENT FORM

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

Project Title: Using Infant Signs to Enhance Communication for Young Hearing Children with Diagnosed Language Delays
Principle Investigator: A. Fain Barker, M.S.
Faculty Advisors: Belinda Hardin, Ph.D., & Jean Kang, Ph.D.
Participant's Name: _____

What is the study about?
The purpose of this study is to investigate the potential benefits of using infant signing on the communication skills of young children with diagnosed language delays as indicated on their Individualized Family Services Plan (IFSP). Your and your child's participation is voluntary.

Why are you asking me?
Families of children ages 12-36 months old who have been diagnosed with language delays are invited to participate in the current study. In order to participate in this study, both the primary caregiver and the child must meet the following criteria: Participants must: (a) be the child's current primary caregiver, (b) live with the child, (c) speak English as the primary language, and (d) spend at least 5 hours a day with the child. In addition, participating children must: (a) currently be between 12-36 months of age; is (b) currently participating in the North Carolina- Infant Toddler Program; (c) have a written IFSP with at least one language related outcome; (d) current say five words or less; (e) have no other diagnosed disabilities; (f) have never been introduced to infant signing or sign language; and (g) not currently receiving speech therapy.

What will you ask me to do if I agree to be in the study?
The entire study will take a total of approximately 30 hours across 8-10 weeks during the summer of 2015.

After returning the "consent to contact" form to your child's service coordinator or child care teacher, the researcher will call you to briefly discuss the study, via the information you included on the form. If you and your child meet all the inclusion criteria, the researcher will then visit you and your child at your home at time that is convenient for you and your family. During this first visit, the researcher will as you to complete a brief survey asking about your child's current communication skills. She will then conduct a brief observation of your child attempting to communicate with you. In addition, you will be asked to complete two brief surveys that will include demographic information and your opinions of using infant signing. The researercher will also review your child's IFSP in order to collect the following data from that form: reason for eligibility, goals, and activities. The first visit should last no longer than 2 hours. The researcher will conduct a brief 1-on-1 parent sign training with you at some point during the first few weeks of the study. This will last about 1 hour.

During the remainder of the study, the researcher will visit your home regularly each week. During these visits, the researcher will collect observation data of you and your child using the signing intervention, as taught during the Parent Sign Training session. In additon, you will be responsible for collecting daily data on your child, by documenting your attempts to sign to your child as well as his/her responses to you. This data will be recorded on an observation form, to be given to you during the Parent Sign Training. Each visit will last about 15-20 minutes.

Towards the end of the study, the researcher will visit you and your child in another comfortable environment that is also a natural environment for your child, such as another family member's home, child care, etc, to observe if your child is able to use the new signing skills in another familiar place. The researcher will then make one last home visit in order to conduct a final language assessment with your child. You will also be asked to complete a final survey about your opinions on using infant signing during this visit.

Finally, by participating in this study, you agree that you will not seek information about infant signing or gestures outside of the study. This would impact the results of the study significantly.

Are there any audio/video recording?
The parent sign training will be video recorded by the researcher for research purposes only. Because you will be potentially identifiable by anyone who watches the video, your confidentiality for things you say on the tape cannot be guaranteed although the researcher will try to limit access to the video by keeping it on her personal

password protected laptop at all times. A second observer will also observe this video from the researcher's personal laptop to ensure the training was conducted as intended.

What are the dangers to me?
The Institutional Review Board at the University of North Carolina at Greensboro has determined that participation in this study poses minimal risk to participants. However, there will be a rare risk of emotional distress for you if they feel uncomfortable sharing information with the researcher. This will be addressed at the beginning of the study and the researcher will explain that they may stop participating at any time in the study. In addition, your child may become frustrated or upset during the intervention process. If this occurs, you will be informed to go about your usual routines without the signing intervention and to make appropriate notes. If you have any concerns about your rights, how you are being treated or if you have questions, want more information or have suggestions, please contact Office of Research Integrity at UNCG toll-free at (855) 251-2351. Questions or concerns about this project or benefits or risks associated with being in this study can be answered by [Fain Barker] who may be contacted at (336) 409-3745 (afblackb@uncg.edu) or Dr. Belinda Hardin at (336) 256-1083 (bjhardin@uncg.edu).

Are there any benefits to me for taking part in this research study?
You and your child may benefit from potential benefits of using infant signing as a communication intervention.

Are there any benefits to society as a result of me taking part in this research?
By participating in this study, you may help make a contribution to the field by addressing the need for (a) enhancing the understanding on the potential benefits of using infant signing with young preverbal hearing children with diagnosed language delays and (b) producing research data for other parents and teachers to use with their children who may benefit from an infant signing intervention.

Will I get paid for being in the study? Will it cost me anything?
You will receive two gift cards totaling $150 to a popular merchant by the end of the study. If you and your child withdraw from the study early or are withdrawn from the study by the researcher, you will not receive the full $150 in gift cards. There are no costs to you for participating in this study.

How will you keep my information confidential?
The data will be coded by the evaluator, de-identified, and kept in a locked cabinet in the faculty advisor's office or on the researcher's password protected personal computer. The master list that links your study number to your name will be kept by the researcher on the password protected personal computer, separately from the data files. Three years after data collection, all data will then be destroyed via vertical shredding. All information obtained in this study is strictly confidential unless disclosure is required by law.

What if I want to leave the study?
You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw, it will not affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a de-identifiable state. Choosing not to participate or withdrawing from the study will not effect your relationship with the North Carolina- Infant Toddler Program in any way. The investigators also have the right to stop your child's participation at any time. This could be because your child has had an unexpected reaction, or has failed to follow instructions, or because the entire study has been stopped.

What about new information/changes in the study?
If significant new information relating to the study becomes available which may relate to your willingness to continue to participate, this information will be provided to you.

Voluntary Consent by Participant:
By signing this consent form, you are agreeing that you have read it or it has been read to you, you fully understand the contents of this document and consent to you and your child taking part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are 18 years and older and are the legal parent or guardian of the child who will participate in this study described to you by Fain Barker.

Signature: _____ Date: _____

UNCG IRB
Approved Consent Form
Valid from:
7/7/15 to **2/24/16**

APPENDIX J

IFSP REVIEW FORM

SECTION 1: INDIVIDUALIZED FAMILY SERVICES PLAN

Date of Birth: _____ Date of Referral: _____
Initial IFSP Meeting Date: _____
IFSP Start Date: _____
Date of interim IFSP meetings: _____

SECTION II: FAMILY'S CONCERNS, PRIORITIES, AND RESOURCES

Participants/ Team Members: _____
Family's Areas of Concern: _____
Priorities of the Family: _____

SECTION IV: IFSP OUTCOMES

Outcome #1: _____
6-month goals: _____
Current functioning: _____
Methods and strategies: _____
Start Date: _____ Target Date: _____

Outcome #2: _____
6-month goals: _____
Current functioning: _____
Methods and strategies: _____
Start Date: _____ Target Date: _____

Outcome #3: _____
6-month goals: _____
Current functioning: _____
Methods and strategies: _____
Start Date: _____ Target Date: _____

APPENDIX K

PROCEDURAL FIDELITY CHECKLIST A: PRIMARY CAREGIVER SIGN TRAINING

Family: _____

Date/Time Observed: _____

Directions: This form will be used by the researcher while training the parent how to implement the signing intervention with his/her child. The researcher will follow the step-by-step training directions stated below and record whether this was completed (Y=Yes), not completed (N=No), or not applicable (NA). One form will be used for each of the 3 signs/words during training as well as during each procedural fidelity data check.

TRAINING SEGMENTS	DIRECTIONS	STATUS	STATUS	STATUS
Parent Learns Target Signs/Words	1. Parent and researcher decide on 3 motivating words/signs for the child to learn.	Y / N / NA	Y / N / NA	Y / N / NA
	2. Researcher models ASL sign for parent a. The parent then repeats the sign	Y / N / NA Y / N / NA	Y / N / NA Y / N / NA	Y / N / NA Y / N / NA
	3. Researcher shows the parent the sign via the website handspeak.com.	Y / N / NA	Y / N / NA	Y / N / NA
Parent Mastery of Signs	4. Researcher models the sign for the parent, while vocally stating the item's name.	Y / N / NA	Y / N / NA	Y / N / NA
	5. Parent repeats the manual sign, while also vocally stating the item's name.	Y / N / NA	Y / N / NA	Y / N / NA
	6. The researcher will document the parent's mastery of each sign after he/she has correctly demonstrated the sign while vocally stating the item's name at least 3 times. (Circle # as parent completes each	1 2 3	1 2 3	1 2 3

TRAINING SEGMENTS	DIRECTIONS	STATUS	STATUS	STATUS
	correctly)			
How to Introduce Signs to Child	7. Researcher tells parent to ensure the items are in the child's current environment.	Y / N / NA	Y / N / NA	Y / N / NA
	8. Researcher will model for the parent how to show the item to the child and *say, "Look, here's your ____" while simultaneously signing the word.* a. The parent repeats the researcher	Y / N / NA Y / N / NA	Y / N / NA Y / N / NA	Y / N / NA Y / N / NA
	b. Researcher tells parent: If the <u>child reaches for the item</u>, the parent will give the child access to the item for a short period of time (10-20 seconds) or the child will be allowed to have a small amount of the item if it is food or drink (i.e., a few sips of a drink or one bite sized piece of food).	Y / N / NA	Y / N / NA	Y / N / NA
	c. Researcher tells parent: If the <u>child does not reach</u> for the item, the parent will introduce the next item and sign to the child.	Y / N / NA	Y / N / NA	Y / N / NA
	d. Researcher tells parent: If the <u>child does not sign/say the name of item</u>, the parent will then sign the name of the item (physical model) and provide a vocal model (e.g., "cookie").	Y / N / NA	Y / N / NA	Y / N / NA
Responding to Spontaneous Requests by Child	9. Researcher tells parent: If the child SPONTANEOUSLY produces a correct or approximated sign or spoken word for the item, t*he parent will then praise the child immediately, saying, "You asked for! Very good. Thank you for telling me you wanted ____."* Then the parent will give the child the item.	Y / N / NA	Y / N / NA	Y / N / NA

TRAINING SEGMENTS	DIRECTIONS	STATUS	STATUS	STATUS
How to Prompt the Child to Request via Sign/Vocally	10. Researcher tells parent to allow the child access to the item for 10-20 seconds, or give the child a small portion of it.	Y / N / NA	Y / N / NA	Y / N / NA
	a. Researcher tells parent to <u>remove the item</u> from the child's access for 5-10seconds, to allow the child to have an opportunity to spontaneously request the item.	Y / N / NA	Y / N / NA	Y / N / NA
	b. Researcher tells parent: If the child does not spontaneously request the item, the parent the parent will then present the child with the same item again,	Y / N / NA	Y / N / NA	Y / N / NA
	c. *while saying, "Do you want the ____?"*	Y / N / NA	Y / N / NA	Y / N / NA
	d. *and simultaneously signing the word, so the child can see the sign being produced.*	Y / N / NA	Y / N / NA	Y / N / NA
	i. Researcher tells parent: *If the child reaches for the item or indicates wanting the item, the parent will then say "tell me you want to the cookie"*	Y / N / NA	Y / N / NA	Y / N / NA
	ii. *while also showing the child the sign.*	Y / N / NA	Y / N / NA	Y / N / NA
	e. Researcher tells parent to then wait 5-10 seconds for the child to respond.	Y / N / NA	Y / N / NA	Y / N / NA
	i. Researcher tells parent: If the child CORRECTLY produces the sign or the spoken word, without approximations, *the parent will praise the child immediately, saying, "You asked for ____! Very good. Thank you for telling me you wanted ____."*	Y / N / NA	Y / N / NA	Y / N / NA

TRAINING SEGMENTS	DIRECTIONS	STATUS	STATUS	STATUS
	ii. Then the parent will give the child the item	Y / N / NA	Y / N / NA	Y / N / NA
	iii. (Parent also signs word as a model when saying the words name.)	Y / N / NA	Y / N / NA	Y / N / NA
	iv. Researcher tells parent: If the child ATTEMPTS to produce the sign or the spoken word, *the parent will say, "Almost! Good try at telling me you wanted the ____."*	Y / N / NA	Y / N / NA	Y / N / NA
	v. *and then show the child by placing his/her hands over the child's hands, molding their hands in order to create the manual sign.*	Y / N / NA	Y / N / NA	Y / N / NA
	vi. The parent will NOT praise the child.	Y / N / NA	Y / N / NA	Y / N / NA
	vii. Then the parent will give the child the item.	Y / N / NA	Y / N / NA	Y / N / NA
	viii. Researcher tells parent: If the child DOES NOT respond at all after 5 seconds, *the parent will place his/her hands over the child's hands, molding their hands in order to create the sign.*	Y / N / NA	Y / N / NA	Y / N / NA
	ix. *The parent will then repeat the process of saying*	Y / N / NA	Y / N / NA	Y / N / NA
	x. *and signing the word*.	Y / N / NA	Y / N / NA	Y / N / NA
	xi. The parent will NOT praise the child.	Y / N / NA	Y / N / NA	Y / N / NA
	xii. Then the parent will give the child the item.	Y / N / NA	Y / N / NA	Y / N / NA
	11. Researcher tells parent: Sign training with the selected item will continue for 5-7 trials, or until the child is no longer interested (e.g., not looking at, reaching for, eating, or drinking the item when given access).	Y / N / NA	Y / N / NA	Y / N / NA

TRAINING SEGMENTS	DIRECTIONS	STATUS	STATUS	STATUS
	a. Researcher tells parent: When this occurs, sign training should begin for next item.	Y / N / NA	Y / N / NA	Y / N / NA
Practice Sessions via Role Play	12. Researcher explains to parent that they will now role play in order to check the parent's mastery of the training session. The researcher will act as the child while the parent acts as him/herself.	Y / N / NA	Y / N / NA	Y / N / NA
	a. <u>Scenario 1: Child spontaneously requests item.</u> i. Parent appropriately responds *praising the child immediately, saying, "You asked for ____! Very good. Thank you for telling me you wanted ____."* 1. Parent simultaneously signs word ii. Then the parent will give the child the item.	Y / N / NA Y / N / NA Y / N / NA	Y / N / NA Y / N / NA Y / N / NA	Y / N / NA Y / N / NA Y / N / NA
	b. <u>Scenario 2: Prompting Child (correct sign/word)</u> i. Parent gives the child the item for 10-20 sec, or a small portion of it. ii. Parent removes item from child for 5-10 sec. iii. "Child" reaches for item. iv. Parent shows the child the item, while saying, "Do you want the ___?" 1. Parent simultaneously signs word v. "Child" reaches for item. vi. Parent says "tell me you want the ___" 1. Parent simultaneously signs word vii. "Child" produces the correct sign AND	Y / N / NA Y / N / NA Y / N / NA Y / N / NA Y / N / NA Y / N / NA	Y / N / NA Y / N / NA Y / N / NA Y / N / NA Y / N / NA Y / N / NA	Y / N / NA Y / N / NA Y / N / NA Y / N / NA Y / N / NA Y / N / NA

TRAINING SEGMENTS	DIRECTIONS	STATUS	STATUS	STATUS
	spoken word for the item.	Y / N / NA	Y / N / NA	Y / N / NA
	viii. Parent *praises the child immediately, saying, "You asked for ____! Very good. Thank you for telling me you wanted ____."*	Y / N / NA	Y / N / NA	Y / N / NA
	1. Parent simultaneously signs word			
	ix. Parent gives the child the item			
	x. Parent scores appropriately	Y / N / NA	Y / N / NA	Y / N / NA
		Y / N / NA	Y / N / NA	Y / N / NA
	c. <u>Scenario 3:Prompting Child (attempted sign, no word)</u>			
	i. Parent gives the child the item for 10-20 sec, or a small portion of it.	Y / N / NA	Y / N / NA	Y / N / NA
	ii. Parent removes item from child for 5-10 sec.	Y / N / NA	Y / N / NA	Y / N / NA
	iii. "Child" produces an approximation of the sign but does not attempt the spoken word.	Y / N / NA	Y / N / NA	Y / N / NA
	iv. Parent says, "*Almost*! *Good try at telling me you wanted the ____.*"	Y / N / NA	Y / N / NA	Y / N / NA
	v. Parent then shows the child by placing his/her hands over the child's hands, molding their hands in order to create the manual sign	Y / N / NA	Y / N / NA	Y / N / NA
	1. While simultaneously saying, "you must want the _____."	Y / N / NA	Y / N / NA	Y / N / NA
	vi. Parent does NOT praise the child.	Y / N / NA	Y / N / NA	Y / N / NA
	vii. Parent gives the child the item, …	Y / N / NA	Y / N / NA	Y / N / NA
	1. while signing and verbally stating the	Y / N / NA	Y / N / NA	Y / N / NA

TRAINING SEGMENTS	DIRECTIONS	STATUS	STATUS	STATUS
	items name. viii. Parent scores appropriately	 Y / N / NA	 Y / N / NA	 Y / N / NA
	d. <u>Scenario 4:Prompting Child (no response after 5 sec)</u>	Y / N / NA	Y / N / NA	Y / N / NA
	i. Parent gives the child the item for 10-20 sec, or a small portion of it.	Y / N / NA	Y / N / NA	Y / N / NA
	ii. Parent removes item from child for 5-10 sec.	Y / N / NA	Y / N / NA	Y / N / NA
	iii. "Child" DOES NOT respond at all (or just reaches)	Y / N / NA	Y / N / NA	Y / N / NA
	iv. Parent then shows the child by placing his/her hands over the child's hands, molding their hands in order to create the manual sign	Y / N / NA	Y / N / NA	Y / N / NA
	1. While simultaneously saying, "you must want the _____."	Y / N / NA	Y / N / NA	Y / N / NA
	v. Parent does NOT praise the child.	Y / N / NA	Y / N / NA	Y / N / NA
	vi. Parent gives the child the item, …	Y / N / NA	Y / N / NA	Y / N / NA
	1. while signing and verbally stating the items name.			
	e. Parent scores appropriately	Y / N / NA	Y / N / NA	Y / N / NA
	f. Researcher repeats any of the 4 scenarios that were not passed with 100% fidelity.	Y / N / NA	Y / N / NA	Y / N / NA
When to End a Training Session	13. Researcher tells parent: If the child doesn't show interest in any of the 3 selected items after 5-7 attempts by the parent to introduce the item to the child, training will end for the day. Training will begin again following the same procedures the next	Y / N / NA	Y / N / NA	Y / N / NA

TRAINING SEGMENTS	DIRECTIONS	STATUS	STATUS	STATUS
	day, or until the child shows interest in the items.			
	14. Researcher tells parent: If the child doesn't show interest after 3 consecutive days of attempting to introduce the items to the child by the parent, the parent and researcher will select other words that are more motivating for the child.	Y / N / NA	Y / N / NA	Y / N / NA
Total Score: ___/___ = ___%				

APPENDIX L

PROCEDURAL FIDELITY CHECKLIST B: PRIMARY CAREGIVER IMPLEMENTATION

Family: _____
Date/Time Observed: _____
Directions: This form will be used by the researcher while observing the parent implement the signing intervention with his/her child during all intervention home visits, 1-2 times weekly. The parent should follow the step-by-step implementation directions stated below. The researcher will record whether each step is completed (+) or not completed (-).

		Word 1: ____	**Word 2: ____**	**Word 3: ____**
	• Gives child access to item for 10-20 seconds • Removes access to item	+ -	+ -	+ -
SPONTANEOUS REQUESTS				
Correct	• No additional prompt • Immediate praise	+ -	+ -	+ -
Attempt	• Hand-over hand (restating the verbal word) • No praise • Gives item to child	+ -	+ -	+ -
PARENT PROMPTED REQUESTS				
	• Asks child "Do you want ___?" • Asks child to "Tell me you want ___" • Simultaneously says/signs word	+ -	+ -	+ -
Correct	• No additional prompt • Immediate praise	+ -	+ -	+ -
Attempt	• Hand-over hand (restating the verbal	+ -	+ -	+ -

		Word 1: ____	Word 2: ____	Word 3: ____
	word) • No praise • Gives item to child			
N/R (5 sec)	• Hand-over hand (restating the verbal word) • No praise • Gives item to child	+ -	+ -	+ -
	# Correct/ # Coded = ____%			

*Spontaneous requests are defined as child initiated verbal/sign attempts or corrects without parent showing the object or once the object is within vision but the verbal/sign has not been modeled by parent.